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XII - STD	2019 - 2020	Marks : 50	1.00 : Hr.
ONE MARK	MATHEMATICS		
TEST NO : 1	1. Applications of Matrices and Determinants, 2. Complex Numbers 3. Theory of Equations		

I. Choose the correct answers from given alternatives : **50 x 1 = 50**

1. 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) $\begin{bmatrix}4 & -1\\2 & 1\end{bmatrix}$

2. $i^n + i^{n+1} + i^{n+2} + i^{n+3}$ is ..... (a) 0 (b) 1 (c) – 1 (d) i

3. 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) $\begin{bmatrix}3 & -3 & 4\\0 & -1 & 1\\2 & -3 & 4\end{bmatrix}$

4. The area of the triangle 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) $2|z|^2$

5. If 'A' is a non singular matrix such that $A^T=\begin{bmatrix}5 & 3\\-2 & -1\end{bmatrix}$ 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) $\begin{bmatrix}5 & -2\\3 & -1\end{bmatrix}$

6. If $Z = 0$, then the arg(Z) is ..... (a) 0 (b) π (c) $\frac{\pi}{2}$ (d) indeterminate

7. The number of positive roots of the polynomial $\sum_{r=0}^{n} {}^nC_r(-1)^r x^r$ is .....
(a) 0 (b) n (c) $< n$ (d) r

8. If α, β and γ are the roots 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) $-\frac{q}{p}$

9. If 'A' and 'B' are invertible matrices, then which of the following is not correct ? .....
(a) adj A = |A|. A^{-1} (b) det $(A)^{-1}$ = [det (A)]$^{-1}$ (c) $(AB)^{-1} = B^{-1}A^{-1}$ (d) $(A + B)^{-1} = B^{-1} + A^{-1}$

10. 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) $\frac{1}{i-2}$

11. If $x^3 + 12x^2 - 10ax + 1999$ definitely has a positive root, if and only if ..... (a) $a \geq 0$ (b) $a > 0$ (c) $a < 0$ (d) $a \leq 0$

12. If $A=\begin{bmatrix}2 & 0\\1 & 5\end{bmatrix}$ and $B=\begin{bmatrix}1 & 4\\2 & 0\end{bmatrix}$ then $|\text{adj }(AB)|$ = ... (a) – 40 (b) – 80 (c) – 60 (d) – 20

13. Which of the following is incorrect ? .....
(a) **Multiplying a complex number by ' i ' is equivalent to rotating the number counter clockwise about the origin through an angle 90°.**
(b) **Multiplying a complex number by ' – i ' is equivalent to rotating the number clockwise about the origin through an angle 90°.**
(c) **Dividing a complex number by ' i ' is equivalent to rotating the number counter clockwise about the origin through an angle 90°.**
(d) **Dividing a complex number by ' i ' is equivalent to rotating the number clockwise about the origin through an angle 90°.**

14. If $\rho(A) = \rho[A.B]$ then the system is .....
(a) **Consistent and has infinitely many solution**
(b) **Consistent and has a unique solution** (c) **Consistent** (d) **Inconsistent**

15. If $\left|z-\frac{3}{z}\right|=2$, then the least value of $|z|$ is .....
(a) 1 (b) 2 (c) 3 (d) 5

16. 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) $\begin{bmatrix}-6 & -2\\5 & -10\end{bmatrix}$

17. If $|z| = 1$, then the value of $\frac{1+z}{1+\bar{z}}$ is .....
(a) z (b) $\bar{z}$ (c) $\frac{1}{z}$ (d) 1

18. According to the rational root theorem, which number is not possible rational root of $4x^4 + 2x^3 - 10x^2 - 5$? ..... (a) – 1 (b) $\frac{5}{4}$ (c) $\frac{4}{5}$ (d) 5

19. Matrices 'A' and 'B' will be inverse of each other only if .....
(a) AB = BA (b) AB = BA = 0 (c) AB = 0, BA = I (d) AB = BA = I

20. 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) $2 + \frac{3}{2}i$

21. 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 solutions if .....
(a) $\lambda = 7, \mu \neq -5$ (b) $\lambda = -7, \mu = 5$ (c) $\lambda = 7, \mu = -5$ (d) $\lambda = 7, \mu = -5$

22. If ' z ' is a complex number such that $z \in \mathbb{C} \setminus \mathbb{R}$ and $z + \frac{1}{z} \in \mathbb{R}$, then $|z|$ is ..... (a) 0 (b) 1 (c) 2 (d) 3

23. If 'I' is the unit matrix of order n, where $k \neq 0$ is a constant, then adj (kI) = ... (a) k^n (adj I) (b) k (adj I) (c) k^2 (adj (I)) (d) k^{n-1} (adj I)

24. z_1, z_2, and z_3 are complex numbers such that $z_1 + z_2 + z_3 = 0$ 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

25. A zero of $x^3 + 64$ is ..... (a) 0 (b) 4 (c) $4i$ (d) -4

26. 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

27. 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

28. 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) $(ABC)^{-1} = C^{-1}B^{-1}A^{-1}$

29. The principal argument of $(\sin 40^0 + i \cos 40^0)^5$ is ....
(a) -110^0 (b) -70^0 (c) 70^0 (d) 110^0

30. The polynomial $x^3 - kx^2 + 9x$ has three real roots if and only if, 'k' satisfies .....
(a) $|k| \leq 6$ (b) $k = 0$ (c) $|k| > 6$ (d) $|k| \geq 6$

31. The polynomial $x^3 + 2x + 3$ has ....
(a) One negative and two real roots (b) One positive and two imaginary roots
(c) Three real roots (d) No solution

32. If $A^T A^{-1}$ is symmetric, then A^2 = ...
(a) A^{-1} (b) $(A^T)^2$ (c) A^T (d) $(A^{-1})^2$

33. If $\omega \neq 1$ is a cubic root of unity and $(1 + \omega)^7 = A + B\omega$, then (A, B) equals ..... (a) (1, 0) (b) (- 1, 1) (c) (0, 1) (d) (1, 1)

34. If $A = \begin{bmatrix} \frac{3}{5} & \frac{4}{5} \\ x & \frac{3}{5} \end{bmatrix}$ and $A^T = A^{-1}$, then the value of 'x' is .....
(a) $\frac{-4}{5}$ (b) $\frac{-3}{5}$ (c) $\frac{3}{5}$ (d) $\frac{4}{5}$

35. If $(1 + i)(1 + 2i)(1 + 3i) \ldots (1 + ni) = x + iy$, then $2.5.10 \ldots (1 + n^2)$ is ..... (a) 1 (b) i (c) $x^2 + y^2$ (d) $1 + n^2$

36. If 'A' is a 3 x 3 non-singular matrix such that $AA^T = A^TA$ and $B = A^{-1}A^T$, then BB^T = ... (a) A (b) B (c) I (d) B^T

37. 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) $\frac{\pi}{2}$

38. If $0 \leq \theta \leq \pi$ and the system of equations $x + (\sin\theta)\, y - (\cos\theta)\, z = 0$, $(\cos\theta)\, x - y + z = 0$, $(\sin\theta)\, x + y - z = 0$ has a non-trivial solution then 'θ' is ..... (a) $\frac{2\pi}{3}$ (b) $\frac{3\pi}{4}$ (c) $\frac{5\pi}{6}$ (d) $\frac{\pi}{4}$

39. The fourth roots of unity are .....
(a) $1 \pm i, -1 \pm i$ (b) $\pm i, 1 \pm i$ (c) $\pm 1, \pm i$ (d) $1, -1$

40. 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

41. If 'A' is a matrix of order 3, then det (kA) = ...
(a) k^3det (A) (b) k^2 det (A) (c) k det (A) (d) det (A)

42. If $\omega \neq 1$ is a cubic root of unity and $\begin{vmatrix} 1 & 1 & 1 \\ 1 & -\omega^2 - 1 & \omega^2 \\ 1 & \omega^2 & \omega \end{vmatrix} = 3k$, then '$k$' is equal to ..... (a) 1 (b) -1 (c) $\sqrt{3}i$ (d) $-\sqrt{3}i$

43. 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) $\begin{bmatrix} 8 & -5 \\ -3 & 2 \end{bmatrix}$

44. 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

45. The number of real numbers in $[0, 2\pi]$ satisfying $\sin^4 x - 2\sin^2 x + 1$ is ..... (a) 2 (b) 4 (c) 1 (d) ∞

46. If $A = \begin{bmatrix} 2 & 3 \\ 5 & -2 \end{bmatrix}$ be such that $\lambda A^{-1} = A$, then 'λ' is .....
(a) 17 (b) 14 (c) 19 (d) 21

47. If $|z - z_1| = |z - z_2|$ then the locus of 'z' is .....
(a) a circle with centre at the origin (b) a circle with centre at z_1
(c) a straight line passing through the origin
(d) is a perpendicular bisector of the line joining z_1 and z_2

48. If f and g are polynomials of degrees m and n respectively, and if $h(x) = (fog)(x)$, then the degree of 'h' is ..... (a) mn (b) $m + n$ (c) m^n (d) n^m

49. 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

50. Identify the correct statement .....
(a) Sum of the moduli of two complex numbers is equal to their modulus of the sum.
(b) Modulus of the product of the complex numbers is equal to the sum of their moduli.
(c) Arguments of the product of two complex numbers is the product of their arguments.
(d) Arguments of the product of two complex numbers is equal to sum of their arguments.

XII - STD	2019 - 2020	Marks : 50	1.00 : Hr.
ONE MARK	MATHEMATICS		
TEST NO : 2	4. Inverse Trigonometric Functions 5. Two Dimensional Analytical Geometry - II 6. Applications of Vector Algebra		

I. Choose the correct answers from given alternatives : **50 x 1 = 50**

1. If $\vec{a}\cdot\vec{b} = \vec{b}\cdot\vec{c} = \vec{c}\cdot\vec{a} = 0$, 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

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

3. If the planes $\vec{r}\cdot(2\hat{i}-\hat{j}+\hat{k}) = 3$ and $\vec{r}\cdot(4\hat{i}+\hat{j}-\mu\hat{k}) = 5$ 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) $\frac{1}{2}, 2$

4. 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) $\frac{3}{5}$

5. 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 $(\vec{a}\times\vec{b})\times(\vec{b}\times\vec{c})$, $(\vec{b}\times\vec{c})\times(\vec{c}\times\vec{a})$ and as coterminous edges is .....

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

6. The locus of the point of intersection of perpendicular tangents to the hyperbola $\frac{x^2}{a^2}-\frac{y^2}{b^2} = 1$ is .....

(a) $x^2 + y^2 = a^2 - b^2$ (b) $x^2 + y^2 = a^2$ (c) $x^2 + y^2 = a^2 + b^2$ (d) $x = 0$

7. If $\sin^{-1}\frac{x}{5} + \operatorname{cosec}^{-1}\frac{5}{4} = \frac{\pi}{2}$, then the value of '$x$' is .....

(a) 4 (b) 5 (c) 2 (d) 3

8. If $|x| \le 1$, 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

9. If $|\vec{a}+\vec{b}| = 60$, $|\vec{a}-\vec{b}| = 40$ and $|\vec{b}| = 46$, then $|\vec{a}|$ is .....

(a) 22 (b) 21 (c) 18 (d) 11

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

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

11. 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) $-\frac{\pi}{5}$

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

(a) 1 (b) – 1 (c) 2 (d) 3

13. If the normals of the parabola $y^2 = 4x$ 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

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

(a) $-17\hat{i} + 21\hat{j} - 97\hat{k}$ (b) $17\hat{i} + 21\hat{j} - 123\hat{k}$

(c) $-17\hat{i} - 21\hat{j} + 97\hat{k}$ (d) $-17\hat{i} - 21\hat{j} - 97\hat{k}$

15. 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) 5 (d) 4

16. If $[\vec{a}\times\vec{b}, \vec{b}\times\vec{c}, \vec{c}\times\vec{a}] = 64$ then $[\vec{a}, \vec{b}, \vec{c}]$ is ... (a) 32 (b) 8 (c) 128 (d) 0

17. The area of quadrilateral formed with feet of the hyperbolas $\frac{x^2}{a^2}-\frac{y^2}{b^2} = 1$ and $\frac{x^2}{b^2}-\frac{y^2}{a^2} = -1$ 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. If $x = \frac{1}{5}$, the value of $\cos(\cos^{-1}x + 2\sin^{-1}x)$ is .....

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

19. The angle between the line $\vec{r} = (\hat{i}+2\hat{j}-3\hat{k}) + t(2\hat{i}+\hat{j}-2\hat{k})$ and the plane $\vec{r}\cdot(\hat{i}+\hat{j}) + 4 = 0$ is ..... (a) 0° (b) 30° (c) 45° (d) 90°

20. 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

21. The vector equation $\vec{r} = (\hat{i}-2\hat{j}-\hat{k}) + t(6\hat{i}-\hat{k})$ 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)

22. 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 coordinates axes. Another ellipse E_2 passing through the point (0, 4) circumscribes the rectangle 'R'. The eccentricity of the ellipse is ..... (a) $\frac{\sqrt{3}}{2}$ (b) $\frac{\sqrt{2}}{2}$ (c) $\frac{1}{2}$ (d) $\frac{3}{4}$

23. If a vector $\vec{a}$ lies in the plane of $\vec{\beta}$ and $\vec{\gamma}$, then .....
(a) $[\vec{a}, \vec{\beta}, \vec{\gamma}] = 1$ (b) $[\vec{a}, \vec{\beta}, \vec{\gamma}] = -1$ (c) $[\vec{a}, \vec{\beta}, \vec{\gamma}] = 0$ (d) $[\vec{a}, \vec{\beta}, \vec{\gamma}] = 2$

24. The locus of the foot of perpendicular from the focus on any tangent to the ellipse $\frac{x^2}{a^2}+\frac{y^2}{b^2}=1$ is .....
(a) $x^2 + y^2 = a^2 - b^2$ (b) $x^2 + y^2 = a^2$ (c) $x^2 + y^2 = a^2 + b^2$ (d) $x = 0$

25. ..... $f(x) = \sin^{-1}\sqrt{x-1}$ is .....
(a) [1, 2] (b) [−1, 1] (c) [0, 1] (d) [− 1, 0]

26. The projection of $3\vec{i}+\vec{j}-\vec{k}$ on $4\vec{i}-\vec{j}+2\vec{k}$ is .....
(a) $\frac{9}{\sqrt{21}}$ (b) $-\frac{9}{\sqrt{21}}$ (c) $\frac{81}{\sqrt{21}}$ (d) $-\frac{81}{\sqrt{21}}$

27. 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) $\frac{1}{4}$

28. 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) $\frac{\pi}{2}$

29. 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) $\frac{a}{b}$

30. 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) $x - \pi$

31. If the function $f(x) = \sin^{-1}(x^2 - 3)$, then ' x ' belongs to .....
(a) [−1, 1] (b) $[\sqrt{2}, 2]$ (c) $[-2, \sqrt{2}] \cup [\sqrt{2}, 2]$ (d) $[-2, -\sqrt{2}] \cap [\sqrt{2}, 2]$

32. 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) $\frac{\pi}{4}$ (d) π

33. 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) $\frac{1}{\sqrt{3}}$

34. Consider the vectors $\vec{a}, \vec{b}, \vec{c}, \vec{d}$ such that $(\vec{a}\times\vec{b})\times(\vec{c}\times\vec{d}) = \vec{0}$. Let P_1 and P_2 be the planes determined by the pairs of vectors $\vec{a}, \vec{b}$ and $\vec{c}, \vec{d}$ respectively. Then the angle between P_1 and P_2 is .....
(b) 0° (b) 45° (c) 60° (d) 90°

35. 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) $\frac{1}{\sqrt{3}}$

36. If $\vec{a}$ and $\vec{b}$ and are parallel vectors, then $[\vec{a}, \vec{c}, \vec{b}]$ is equal to .....
(a) ..... − 1 (c) 1 (d) 0

37. If the two tangents drawn from a point ' P ' to the parabola $y^2 = 4x$ are at right angles then the locus of ' P ' is .....
(a) $2x + 1 = 0$ (b) $x = -1$ (c) $2x - 1 = 0$ (d) $x = 1$

38. If the direction cosines of a line are $\frac{1}{c}, \frac{1}{c}, \frac{1}{c}$ then .....
(a) $c = \pm 3$ (b) $c = \pm\sqrt{3}$ (c) $c > 0$ (d) $0 < c < 1$

39. 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) $9, \frac{40}{9}$ (b) 0 (c) $\frac{40}{9}$ (d) $\frac{40}{9}$

40. The value of $\sin^{-1}\left(\cos\left(\frac{43\pi}{5}\right)\right)$ is ..... (a) $\frac{3\pi}{5}$ (b) $\frac{-7\pi}{5}$ (c) $\frac{\pi}{10}$ (d) $-\frac{\pi}{10}$

41. If a line makes 45°, 60° with positive direction of axes ' x ' and ' y ' then the angle it makes with the z-axis is ..... (a) 30° (b) 90° (c) 45° (d) 60°

42. If ' e ' is the eccentricity of the ellipse $\frac{x^2}{a^2}+\frac{y^2}{b^2}=1$ $(a < b)$, then .....
(a) $b^2 = a^2(1 - e^2)$ (b) $a^2 = b^2(1 - e^2)$ (c) $a^2 = b^2(e^2 - 1)$ (d) $b^2 = a^2(e^2 - 1)$

43. 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

44. The circle passing through (1, − 2) and touching the axis of ' x ' at (3, 0) passing through the point ..... (a) (− 3, 2) (b) (2, − 5) (c) (5, − 2) (d) (− 2, 5)

45. $\sin^{-1}(\cos x) = \frac{\pi}{2} - x$ is valid for .....
(a) $-\pi \le x \le 0$ (b) $0 \le x \le \pi$ (c) $-\frac{\pi}{2} \le x \le \frac{\pi}{2}$ (d) $-\frac{\pi}{4} \le x \le \frac{3\pi}{4}$

46. The angle between the lines $\frac{x-2}{3}=\frac{y+1}{-2}, z=2$ and $\frac{x-1}{1}=\frac{2y+3}{3}=\frac{z+1}{2}$ is ..... (a) $\frac{\pi}{6}$ (b) $\frac{\pi}{4}$ (c) $\frac{\pi}{3}$ (d) $\frac{\pi}{2}$

47. The equation of the normal to the circle $x^2 + y^2 - 2x - 2y + 1 = 0$ which is parallel to the line $2x + 4y = 3$ is .....
(a) $x + 2y = 3$ (b) $x + 2y + 3 = 0$ (c) $2x + 4y + 3 = 0$ (d) $x - 2y + 3 = 0$

48. 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

49. The work done in moving a particle from the point 'A' with position vector $2\vec{i}-6\vec{j}+7\vec{k}$ to the point 'B', with position vector $\vec{i}+\vec{j}+\vec{k}$ by a force $\vec{F}=\vec{i}+3\vec{j}-\vec{k}$ is ..... (a) 25 (b) 26 (c) 27 (d) 28

50. The normal at ' t_1 ' on the parabola $y^2 = 4ax$ meets the parabola again at ' t_2 ' then $t_2 = -\frac{2}{t_1}$ is ..... (a) $-t_1$ (b) t_1 (c) $t_1 + t_2$ (d) .....

XII - STD	2019 - 2020	Marks : 50	1.00 : Hr.
ONE MARK	MATHEMATICS		
TEST NO : 3	7. Application of Differential Calculus 8. Differentials and Partial Derviatives		

I. Choose the correct answers from given alternatives : **50 x 1 = 50**

1. 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) $4\sqrt{3}$

2. 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 %

3. Angle between $y^2 = x$ and $x^2 = y$ at the origin is .....
(a) $\tan^{-1}\frac{3}{4}$ (b) $\tan^{-1}\left(\frac{4}{3}\right)$ (c) $\frac{\pi}{2}$ (d) $\frac{\pi}{4}$

4. 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) e^2u (d) y^2u

5. The distance travelled by a car in 't' seconds is given by $x = 3t^3 - 2t^2 + 4t - 1$. Then the initial velocity and initial acceleration respectively are .....
(a) $(-4m/s, 4m/s^2)$ (b) $(4m/s, -4m/s^2)$ (c) (0, 0) (d) $(18.25\ m/s, 22\ m/s^2)$

6. 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) yx^{y-1} (d) $x \log y$

7. The function $\sin^4 x + \cos^4 x$ is increasing in the interval .....
(a) $\left[\frac{5\pi}{8}, \frac{3\pi}{4}\right]$ (b) $\left[\frac{\pi}{2}, \frac{5\pi}{8}\right]$ (c) $\left[\frac{\pi}{4}, \frac{\pi}{2}\right]$ (d) $\left[0, \frac{\pi}{4}\right]$

8. If $u = \frac{1}{\sqrt{x^2+y^2}}$, then $x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y}$ = ... (a) $\frac{1}{2}u$ (b) u (c) $\frac{3}{2}u$ (d) $-u$

9. 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

10. 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

11. The maximum slope of the tangent to the curve $y = e^x \sin x$, $x \in [0, 2\pi]$ is at ..... (a) $x = \frac{\pi}{4}$ (b) $x = \frac{\pi}{2}$ (c) $x = \pi$ (d) $x = \frac{3\pi}{2}$

12. 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) $(\sqrt{13}, -\sqrt{3})$

13. If $f(x, y, z) = xy + yz + zx$, then $f_x - f_z$ is equal to .....
(a) $z - x$ (b) $y - z$ (c) $x - z$ (d) $y - x$

14. 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

15. 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

16. 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) $t = 3$

17. 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) $3e^{2t} + 5\sin t + 4\cos t \sin t$

18. 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) $12x_0 dx$ (c) $6x_0 dx$ (d) $6x_0 + dx$

19. $\lim_{x \to 0} \frac{x}{\tan x}$ is ..... (a) 1 (b) -1 (c) 0 (d) ∞

20. 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) $(1 + x)e^{xy}$

21. Find 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)

22. The point that separates the convex part of a continuous curve from the concave part is ..... (a) the maximum point (b) the minimum point
(c) the inflection point (d) critical point

23. The point of inflection of the curve $y = (x - 1)^3$ is .....
(a) (0, 0) (b) (0, 1) (c) (1, 0) (d) (1, 1)

24. If $v(x, y) = \log(e^x + e^y)$, then $\frac{\partial v}{\partial x} + \frac{\partial v}{\partial y}$ is equal to .....
(a) $e^x + e^y$ (b) $\frac{1}{e^x + e^y}$ (c) 2 (d) 1

25. The maximum product of two positive numbers, when their sum of the squares is 200, is ..... (a) 100 (b) $25\sqrt{2}$ (c) 28 (d) $24\sqrt{11}$

(over)

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

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

27. 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

28. *l'* Hospital's rule cannot be applied to $\frac{x+1}{x+3}$ as $x \to 0$ because $f(x) = x + 1$ and $g(x) = x + 3$ are .....

(a) not continuous (b) not differentiable

(c) not in the indeterminate form as $x \to 0$

(d) in the indeterminate form as $x \to 0$

29. 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

30. 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) $-x - \frac{\pi}{2}$

31. The minimum value of the function $|3 - x| + 9$ is .....

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

32. The number given by the Rolle's theorem for the function $x^3 - 3x^2$, $x \in [0, 3]$ is ..... (a) 1 (b) $\sqrt{3}$ (c) $\frac{3}{2}$ (d) 2

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

(a) $0.3\,x\,dx\ m^3$ (b) $0.03\,x\ m^3$ (c) $0.03\,x^2\ m^3$ (d) $0.03\,x^3\ m^3$

34. What is the value of the limit $\lim_{x \to 0}\left(\cot x - \frac{1}{x}\right)$? (a) 0 (b) 1 (c) 2 (d) ∞

35. 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) $\frac{-1}{x+1}dx$

36. 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) $y = \pm 3$

37. Food pockets were dropped from an helicopter during the flood and distance fallen in 't' seconds is given by $y = \frac{1}{2}gt^2$ ($g = 9.8\ m/s^2$). Then the speed of the food pocket after it has fallen for '2' seconds is .....

(a) 19.6 m/sec (b) 9.8 m/sec (c) -19.6 m/sec (d) -9.8 m/sec

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

39. If $\lim_{x \to a} g(x) = b$ and 'f' is continuous at $x = b$ then .....

(a) $\lim_{x \to a} g(f(x)) = f\left[\lim_{x \to a} g(x)\right]$ (b) $\lim_{x \to a} f(g(x)) = f\left[\lim_{x \to a} g(x)\right]$

(c) $\lim_{x \to a} f(g(x)) = g\left[\lim_{x \to a} f(x)\right]$ (d) $\lim_{x \to a} f(g(x)) \neq f\left[\lim_{x \to a} g(x)\right]$

40. If $u(x, y) = x^4 + y^3 + 3x^2y^2 + 3x^2y$ then $\frac{\partial^2 u}{\partial y^2}$ = ...

(a) $6y + 6x^2$ (b) $12xy - 6x$ (c) $12x^2y - 6x$ (d) $3y^2 + 6x^2y + 3x^2$

41. 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

42. If $f(x) = x^2 - 4x + 5$ on $[0, 3]$ then the absolute maximum value is .....

(a) 2 (b) 3 (c) 4 (d) 5

43. One of the conditions of Rolle's theorem is .....

(a) 'f' is defined and continous on (a, b) (b) 'f' is differentiable on $[a, b]$

(c) $f(a) = f(b)$ (d) 'f' is differentiable on (a, b)

44. Which of the following function is increasing in $(0, \infty)$? .....

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

45. A balloon rises straight up at 10 m/s. An observer is 40 m away from the spot where the balloon left the ground. Find 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

46. 'f' is a twice differentiable function on an interval 'I' and if for all 'x' in the domain 'I' of 'f', then 'f' is .....

(a) concave upward (b) convex upward (c) increasing (d) decreasing

47. The function $f(x) = x^2 - 5x + 4$ is increasing in .....

(a) $(-\infty, 1)$ (b) $(1, 4)$ (c) $(4, \infty)$ (d) Everywhere

48. If $u = y \sin x$, then $\frac{\partial^2 u}{\partial x \partial y}$ = ... (a) $\cos x$ (b) $\cos y$ (c) $\sin x$ (d) 0

49. 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 $\frac{1}{2}$ cm .....

(a) 3 cm/s (b) 2 cm/s (c) 1 cm/s (d) $\frac{1}{3}$ cm/s

50. $\lim_{x \to \infty} \frac{x^2}{e^x}$ is = ... (a) 2 (b) 0 (c) ∞ (d) 1

XII - STD	2019 - 2020	Marks : 50	1.00 : Hr.
ONE MARK	MATHEMATICS		
TEST NO : 4	9. Applications of Integeration 10. Ordinary Differential Equations		

I. Choose the correct answers from given alternatives : **50 x 1 = 50**

1. 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

2. 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) $y = 3x^3 + 4$ (c) $y = 3x^3 + 4$ (d) $y = x^3 + 5$

3. For any value of $n \in \mathbf{Z}$ $\int_0^{\pi} e^{\cos^2 x} \cos^3[(2n+1)x]\, dx$ is .....
(a) $\frac{\pi}{2}$ (b) π (c) 0 (d) 2

4. If 'p' and 'q' are the order and degree of the differential equation $y\frac{dy}{dx} + x^3\left(\frac{d^2y}{dx^2}\right)^2 + xy = \cos x$ when .....
(a) $p < q$ (b) $p = q$ (c) $p > q$ (d) p exists and q does not exist

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

6. 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) $\frac{1}{x^2}$

7. The value of $\int_{-1}^{1} \left[\tan^{-1}\left(\frac{x^2}{x^4+1}\right) + \tan^{-1}\left(\frac{x^4+1}{x^2}\right)\right] dx$ is .....
(a) π (b) 2π (c) 3π (d) 4π

8. If $\int_0^a \frac{1}{4+x^2}\, dx = \frac{\pi}{8}$ then 'a' is ..... (a) 4 (b) 1 (c) 3 (d) 2

9. 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) $\frac{2}{27}$

10. 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) $x = ce^{\int pdy}$

11. The value of $\int_{\frac{\pi}{4}}^{\frac{3\pi}{4}} \left(\frac{2x^6 - 3x^5 + 7x^2 - x + 1}{\cos^2 x}\right) dx$ is ..... (a) 4 (b) 3 (c) 2 (d) 0

12. The value of $\int_0^1 x(1-x)^4\, dx$ ..... (a) $\frac{1}{12}$ (b) $\frac{1}{30}$ (c) $\frac{1}{24}$ (d) $\frac{1}{20}$

13. The general solution of the differential equation $\log\left(\frac{dy}{dx}\right) = x + y$ is .....
(a) $e^x + e^y = C$ (b) $e^x + e^{-y} = C$ (c) $e^{-x} + e^y = C$ (d) $e^{-x} + e^{-y} = C$

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

15. The solution of the differential equation $\frac{dy}{dx} = \frac{y}{x} + \frac{\phi\left(\frac{y}{x}\right)}{\phi'\left(\frac{y}{x}\right)}$ is .....
(a) $x\phi\left(\frac{y}{x}\right) = k$ (b) $\phi\left(\frac{y}{x}\right) = kx$ (c) $y\phi\left(\frac{y}{x}\right) = k$ (d) $\phi\left(\frac{y}{x}\right) = ky$

16. $\int_0^{\infty} x^5 e^{-4x}\, dx$ is ..... (a) $\frac{\angle 6}{4^6}$ (b) $\frac{\angle 6}{4^5}$ (c) $\frac{\angle 5}{4^6}$ (d) $\frac{\angle 5}{4^5}$

17. 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) $\frac{dy}{dx} - y = 0$

18. If $\frac{dy}{dx} = \frac{x-y}{x+y}$ then .....
(a) $2xy + y^2 + x^2 = c$ (b) $x^2 + y^2 - x + y = c$ (c) $x^2 + y^2 - 2xy = c$ (d) $x^2 - y^2 - 2xy = c$

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

20. '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) $Pt = C$

21. 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) $\frac{1}{3}$

22. In finding the differential equation corresponding to $y = e^{mx}$ where 'm' is the arbitrary constant, then 'm' is ..... (a) $\frac{y}{y'}$ (b) $\frac{y'}{y}$ (c) y' (d) y

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

24. 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) $\sqrt{\frac{1}{x+1}}$ (d) $\sqrt{x+1}$

25. 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) $x\sin x$

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26. The order and degree of the differential equation $\frac{d^2y}{dx^2} - y + \left(\frac{dy}{dx} + \frac{d^2y}{dx^3}\right)^{\frac{3}{2}} = 0$ are ..... (a) 2, 3 (b) 3, 3 (c) 3, 2 (d) 2, 2

27. The integrating factor of the differential equation $\frac{dy}{dx} + y = \frac{1+y}{\lambda}$ is ..... (a) $\frac{x}{e^2}$ (b) $\frac{e^4}{x}$ (c) λe^x (d) e^x

28. If $f(x) = \int_1^x \frac{e^{\sin u}}{u} du$, $x > 1$ 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

29. 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) $\log y = kx$

30. 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) $\frac{1}{10001}$

31. If $\frac{\Gamma(n+2)}{\Gamma(n)} = 90$ then 'n' is ..... (a) 10 (b) 5 (c) 8 (d) 9

32. The value of $\int_0^a \left(\sqrt{a^2 - x^2}\right)^3 dx$ is ..... (a) $\frac{\pi a^3}{16}$ (b) $\frac{3\pi a^3}{16}$ (c) $\frac{3\pi a^2}{8}$ (d) $\frac{3\pi a^4}{8}$

33. The solution of the differential equation $\frac{dy}{dx} + \frac{1}{\sqrt{1-x^2}} = 0$ is .....

(a) $y + \sin^{-1} x = c$ (b) $x + \sin^{-1} y = 0$ (c) $y^2 + 2\sin^{-1} x = C$ (d) $x^2 + 2\sin^{-1} y = 0$

34. 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) $\frac{\pi^2}{4} - 2$

35. 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) $\frac{d^2x}{dy^2} = 0$

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

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

37. 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) $P = C$

38. The area bounded by the parabola $y^2 = x$ and its latus rectum is ..... (a) $\frac{4}{3}$ (b) $\frac{1}{6}$ (c) $\frac{2}{3}$ (d) $\frac{8}{3}$

39. 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

40. 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) $y = x^2 + C$

41. The differential equation corresponding to $xy = c^2$ where 'c' is an arbitrary constant, is .....

(a) $xy'' + x = 0$ (b) $y'' = 0$ (c) $xy' + y = 0$ (d) $xy'' - x = 0$

42. The degree of the differential equation $y(x) = 1 + \frac{dy}{dx} + \frac{1}{1.2}\left(\frac{dy}{dx}\right)^2 + \frac{1}{1.2.3}\left(\frac{dy}{dx}\right)^3 + \ldots$ is ..... (a) 2 (b) 3 (c) 1 (d) 4

43. $\int_0^\infty e^{-mx} x^7 dx$ is ..... (a) $\frac{\angle m}{7^m}$ (b) $\frac{\angle 7}{m^7}$ (c) $\frac{\angle m}{7^{m+1}}$ (d) $\frac{\angle 7}{m^8}$

44. The solution of the differential equation $2x\frac{dy}{dx} - y = 3$ represents ..... (a) Straight lines (b) Circles (c) Parabola (d) Ellipse

45. 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) $\frac{\pi a^3}{6}$

46. $\int_0^\infty x^6 e^{-\frac{x}{2}} dx$ is ..... (a) $\frac{\angle 6}{2^7}$ (b) $\frac{\angle 6}{2^6}$ (c) $2^6 \angle 6$ (d) $2^7 \angle 6$

47. 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

48. 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) $\cot x$

49. The value of $\int_{-1}^2 |x|\,dx$ is ..... (a) $\frac{1}{2}$ (b) $\frac{3}{2}$ (c) $\frac{5}{2}$ (d) $\frac{7}{2}$

50. The integrating factor of the differential equation $\frac{dy}{dx} - y\tan x = \cos x$ is .....

(a) $\sec x$ (b) $\cos x$ (c) $e^{\tan x}$ (d) $\cot x$

XII - STD	2019 - 2020	Marks : 50	1.00 : Hr.
ONE MARK	MATHEMATICS		
TEST NO : 5	11. Probability 12. Discrete Mathematics		

I. Choose the correct answers from given alternatives : **50 x 1 = 50**

1. 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) $\frac{57}{20}$

2.

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

3. 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

4. Which one is the contrapositive of the statement $(p \vee q) \rightarrow \neg r$? .....
(a) $\neg r \rightarrow (\neg p \wedge \neg q)$ (b) $\neg r \rightarrow (p \vee q)$ (c) $r \rightarrow (p \wedge q)$ (d) $p \rightarrow (q \vee r)$

5. The probability 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) $\frac{2}{3}$

6. 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

7. If $f(x) = \begin{cases} 2x, 0 \le x \le a \\ 0, otherwise \end{cases}$ is a probability density function of random variable, then the value of 'a' is ..... (a) 1 (b) 2 (c) 3 (d) 4

8. 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) $i + 2n$, $i = 0, 1, 2, \ldots n$ (b) $2i - n$, $i = 0, 1, 2, \ldots n$
(c) $n - i$, $i = 0, 1, 2, \ldots n$ (d) $2i + 2n$, $i = 0, 1, 2, \ldots n$

9. If the function $f(x) = \frac{1}{12}$ for $a < x < b$, 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

10. 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) $\sqrt{3}$ is an irrational number

11. 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

12. Var $(4X + 3)$ is ..... (a) 7 (b) 16 Var (X) (c) 19 (d) 0

13. 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) $\neg(\neg p) \equiv p$

14. 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 $\frac{1}{2}$ (b) $\frac{1}{2}$ and 1 (c) 2 and 1 (d) 1 and 2

15. 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) $\neg(p \wedge q) \wedge [p \wedge (p \vee \neg r)]$

16. Given $E(X + c) = 8$ and $E(X - c) = 12$ then the value of 'c' is .....
(a) -2 (b) 4 (c) -4 (d) 2

17. The operation $*$ defined by $a * b = \frac{ab}{7}$ is not a binary operation on .....
(a) Q^+ (b) Z (c) R (d) C

18. In the set of integers with operation $*$ defined by $a * b = a + b - ab$, the value of $3 * (4 * 5)$ is ..... (a) 25 (b) 15 (c) 10 (d) 5

19. If $P\{X = 0\} = 1 - P\{X = 1\}$. If $E[X] = 3$ Var (X), then $P\{X = 0\}$ .....
(a) $\frac{2}{3}$ (b) $\frac{2}{5}$ (c) $\frac{1}{5}$ (d) $\frac{1}{3}$

20. Which one of the following is not true ? .....
(a) Negation of a negation of a statement is the statement itself.
(b) If the last column of the truth table contains only T then it is a tautology.
(c) If the last column of its truth table contains only F then it is a contradiction.
(d) If p and q are any two statements then $p \leftrightarrow q$ is a tautology.

21. 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

22. Which of the following are statements ? .....
(i) Chennai is the capital of TamilNadu (ii) The earth is a planet
(iii) Rose is a flower (iv) Every triangle is an isosceles triangle
(a) all (b) (i) and (ii) (c) (ii) and (iii) (d) (iv) only

23. 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 selectetd. 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. The $E[X]$ and $E[Y]$ respectively are ..... (a) 50, 40 (b) 40, 50 (c) 40, 75, 40 (d) 41, 41

24. 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) $(S \times S) \to (S \times S)$

25. 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 $P(X = 0) = \frac{1}{7}$. Then the value of 'k' is ..... (a) 1 (b) 2 (c) 3 (d) 4

26. If 'p' stands for the statement "Sita likes reading" and 'q' for the statement 'Sita likes playing". "Sita likes neither reading nor playing" stands for ..... (a) $\neg p \wedge \neg q$ (b) $p \wedge \neg q$ (c) $\neg p \wedge q$ (d) $p \wedge q$

27. 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

28. 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

29. In the set $\mathbf{Q}$ 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) $y = 4$

30. If X is a binomial random variable with expected value 6 and variance 2.4. Then $P(X = 5)$ is .....
(a) $\binom{10}{5}\left(\frac{3}{5}\right)^5\left(\frac{2}{5}\right)^5$ (b) $\binom{10}{5}\left(\frac{3}{5}\right)^5$ (c) $\binom{10}{5}\left(\frac{3}{5}\right)^5\left(\frac{2}{5}\right)^5$ (d) $\binom{10}{5}\left(\frac{3}{5}\right)^5\left(\frac{2}{5}\right)^5$

31. 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) $\frac{2}{243}$

32. A rod of length $2l$ is broken into two pieces at random. The probability density function of the shorter of the two pieces is .....
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) $\frac{l}{2}, \frac{l^2}{12}$ (d) $\frac{l}{2}, \frac{l^2}{12}$

33. The truth table for $(p \wedge q) \vee \neg q$ 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

34. Consider a game where the player tosses a six-sided fair die. If the face that comes up is 6, the player wins ₹ 36, otherwise he loses ₹ 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) $\frac{10}{6}$ (b) $-\frac{10}{6}$ (c) $\frac{3}{2}$ (d) $-\frac{3}{2}$

35. Subtraction is not a binary operation in ..... (a) R (b) Z (c) N (d) Q

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

37. 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 and 1 + 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

38. If $f(x) = \begin{cases} kx^2, & 0 < x < 3 \\ 0, & \text{elsewhere} \end{cases}$ is a probability density function then the value of 'k' is ..... (a) $\frac{1}{3}$ (b) $\frac{1}{6}$ (c) $\frac{1}{9}$ (d) $\frac{1}{12}$

39. Which one of the following is a binary operation on 'N' ? .....
(a) Subtraction (b) Multiplication (c) Division (d) All the above

40. 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

41. If 'p' is true and 'q' is unknown then .....
(a) $p \wedge q$ is true (b) $p \vee (\neg p)$ is false (c) $p \wedge (\neg p)$ is true (d) $(p \vee q)$ is true

42. Which one is the inverse of the statement $(p \wedge q) \to (p \vee q)$? .....
(a) $(p \wedge q) \to (p \vee q)$ (b) $\neg(p \vee q) \to (p \wedge q)$
(c) $(\neg p \wedge \neg q) \to (\neg p \vee \neg q)$ (d) $(\neg p \wedge \neg q) \to (\neg p \vee \neg q)$

43. 'X' is a random variable taking the values 3, 4 and 12 with probabilites $\frac{1}{2}$, $\frac{1}{3}$ and $\frac{1}{12}$. Then $E(X)$ is ..... (a) 5 (b) 7 (c) 6 (d) 3

44. 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

45. A random variable 'X' binomial distribution with $n = 25$ and $p = 0.8$ then standard deviation of 'X' is ..... (a) 5 (b) 4 (c) 3 (d) 2

46. Variance of the random variable X is 4. Its mean is 2. Then $E(X^2)$ is ..... (a) 2 (b) 4 (c) 6 (d) 8

47. In the set $\mathbf{R}$ of real numbers '$*$' is defined as follows. Which one of the following is not a binary operation on $\mathbf{R}$? .....
(a) $a * b = \min(a, b)$ (b) $a * b = \max(a, b)$
(c) $a * b = a$ (d) $a * b = a^2$

48. The proposition $p \vee (\neg p \wedge q)$ is ..... (a) a tautology (b) a contradiction
(c) logically equivalent to $p \wedge q$ (d) logically equivalent to $p \vee q$

49. If in 6 trials, 'X' is a binomial variate which follows the relation $9\,P(X = 4) = P(X = 2)$, then the probability of success is .....
(a) 0.125 (b) 0.25 (c) 0.375 (d) 0.75

50. If 'p' is 'T' and 'q' is 'F', then which of the following have the truth value 'T' ? ..... (i) $p \vee q$ (ii) $\neg p \wedge q$ (iii) $p \wedge \neg q$ (iv) $\neg p \wedge \neg q$
(a) (i), (ii), (iii) (b) (i), (ii), (iv) (c) (i), (iii), (iv) (d) (ii), (iii), (iv)