Delhi Public School, Faridabad

Test Series-2

Mathematics, Class-12

Maximum Marks: 40 | **Duration: 90 minutes** | **Date: 13.10.2021**

General Instructions:

(i) This question paper contains three Sections-A,B and C. Each part is compulsory.

(ii) Section-A has 20 MCQs, attempt any 16 out of 20.

(iii) Section-B has 20 MCQs, attempt any 16 out of 20.

(iv) Section-C has 10 MCQs, attempt any 8 out of 10.

(v) There is no negative marking.

(vi) All questions carry equal marks.

SECTION-A

this section, attempt any 16 questions out of Question No.1-20. Each question is of 1 mark weightage.

1. Let $A = \{1, 2, 3, \dots, n\}$ and $B = \{a, b, c\}$. Then the number of functions from A to B is

   A. ${}^nP_3$ B. ${}^nC_3$ C. 3^n D. 3^{n-1}

2. If A and B are two equivalence relations defined on set C, then

   A. $A \cap B$ is an equivalence relation B. $A \cup B$ is not an equivalence relation C. $A \cup B$ is an equivalence relation
   D. $A \cap B$ is not an equivalence relation

3. The principal value of $\tan^{-1}\left(\tan\frac{3\pi}{5}\right)$ is

   A. $\frac{2\pi}{5}$ B. $-\frac{2\pi}{5}$ C. $\frac{3\pi}{5}$ D. $-\frac{3\pi}{5}$

4. The range of the principal value branch of the function $y = \sec^{-1} x$ is

   A. $[0, \pi]$ B. $\left[-\frac{\pi}{2}, \frac{\pi}{2}\right]$ C. $[0, \pi] - \left\{\frac{\pi}{2}\right\}$ D. None of these

5. If $\begin{bmatrix} 2 & 3 \\ 5 & 7 \end{bmatrix}\begin{bmatrix} 1 & -3 \\ -2 & 4 \end{bmatrix} = \begin{bmatrix} -4 & 6 \\ -9 & x \end{bmatrix}$, the value of x is

   A. 9 B. 11 C. 13 D. None of these

6. Given a skew-symmetric matrix $A = \begin{bmatrix} 0 & a & 1 \\ -1 & b & 1 \\ -1 & c & 0 \end{bmatrix}$, the value of $(a+b+c)^2$ is

   A. 0 B. 1 C. 2 D. 3

7. If matrix $A = \begin{bmatrix} 1 & -1 \\ -1 & 1 \end{bmatrix}$ and $A^2 = kA$, then the value of k is

   A. 1 B. 2 C. 3 D. 5

8. If $A = \begin{bmatrix} 2 & 0 & 0 \\ 0 & 2 & 0 \\ 0 & 0 & 2 \end{bmatrix}$, then A^3 is equal to

   A. A B. 2A C. 4A D. 8A

9. Assuming that the sums and products given below are defined, which of the following is not true for matrices?

A. $A+B=B+A$ B. $AB=AC$ does not imply $B=C$ C. $AB=O$ implies $A\neq O$ or $B\neq O$ D. $(AB)'=B'A'$

10. If A is a square matrix of order 3, such that $A(adj A)=10I$, then $|adj A|$ is equal to

A. 1 B. 10 C. 100 D. 101

11. If A is any square matrix of order 3×3 such that $|A|=-4$, then the value of $|A.adj A|$ is

A. 16 B. 64 C. -16 D. -64

12. The function

$$f(x)=\begin{cases}\frac{\sin x}{x}+\cos x, & x\neq 0\\ k, & x=0\end{cases}$$

is continuous at $x=0$, then find the value of k is

A. 3 B. 2 C. 1 D. 1.5

13. If $\cos(xy)=k$, where k is a constant and $xy\neq n\pi, n\in Z$, then $\frac{dy}{dx}$ is equal to

A. $\frac{x}{y}$ B. $-\frac{x}{y}$ C. $\frac{y}{x}$ D. $-\frac{y}{x}$

14. If $y=x+\sqrt{x^2-1}$, then $(y-x)\frac{dy}{dx}$ is

A. $-y$ B. y C. $\frac{1}{y}$ D. y^2

15. If tangent to the curve $y^2+3x-7=0$ at the point (h,k) is parallel to line $x-y=4$, then value of k is

A. -3 B. $-\frac{3}{2}$ C. $\frac{3}{2}$ D. $\frac{2}{3}$

16. The normal to the curve $x^2=4y$ passing $(1,2)$ is

A. $x+y=3$ B. $x-y=3$ C. $x+y=1$ D. $x-y=1$

17. The stationary point of function $f(x)=x^x, x>0$ is

A. $x=e$ B. $x=-1$ C. $x=1$ D. None of these

18. The function $f(x)=4\sin^3 x-6\sin^2 x+12\sin x+100$ is strictly

A. increasing in $\left(\pi,\frac{3\pi}{2}\right)$ B. decreasing in $\left(\frac{\pi}{2},\pi\right)$ C. decreasing in $\left(-\frac{\pi}{2},\frac{\pi}{2}\right)$ D. decreasing in $\left(0,\frac{\pi}{2}\right)$

19. If $2^x+2^y=2^{x+y}$, then $\frac{dy}{dx}$ is equal to

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

20. Corner points of the feasible region determined by the system of linear constraints are $(0,2)$, $(3,0)$, $(6,0)$, $(6,8)$ and $(0,5)$. Let $Z=4x+6y$ be the objective function. The minimum value of Z occurs at:

A. $(6,8)$ only B. $(3,0)$ only C. $(0,2)$ only D. any point of the line segment joining the points $(0,2)$ and $(3,0)$

SECTION-B

In this section, attempt any 16 questions out of Question No.21-40. Each question is of 1 mark weightage.

21. Let $f:[2,\infty)\to R$ be the function defined by $f(x)=x^2-4x+5$. Find the range of f is

A. R B. $[1,\infty)$ C. $[4,\infty)$ D. $[5,\infty)$

22. A relation R in $S=\{1,2,3\}$ is defined as $R=\{(1,1),(2,2),(3,3),(1,2)\}$. Which element(s) of relation R be removed to make R an equivalence relation?

A. $(1,1)$ B. $(2,2)$ C. $(3,3)$ D. $(1,2)$

23. If a relation R on the set $\{4,2,7\}$ be defined by $R=\{2,7)\}$, then R is

A. reflexive B. transitive C. symmetric D. none of these

24. Domain of $\sin x+\sin^{-1}x$ is

A. $(-1,1)$ B. $[0,1]$ C. $[-1,1]$ D. R

25. $\sin^{-1}(1-x)-2\sin^{-1}x=\frac{\pi}{2}$, then x is equal to

A. $0,\frac{1}{2}$ B. $1,\frac{1}{2}$ C. 0 D. $\frac{1}{2}$

26. The value of the expression $\tan\left[\frac{1}{2}\cos^{-1}\frac{2}{\sqrt{5}}\right]$ is

A. $2+\sqrt{5}$ B. $\sqrt{5}-2$ C. $\frac{\sqrt{5}+2}{2}$ D. $5+\sqrt{5}$

27. If $A+B=\begin{bmatrix}1&0\\1&1\end{bmatrix}$ and $A-2B=\begin{bmatrix}-1&1\\0&-1\end{bmatrix}$, then A is

A. $\frac{1}{4}\begin{bmatrix}1&1\\2&1\end{bmatrix}$ B. $\frac{1}{3}\begin{bmatrix}1&1\\2&1\end{bmatrix}$ C. $\begin{bmatrix}1&1\\2&1\end{bmatrix}$ D. $\begin{bmatrix}1&1\\3&2\end{bmatrix}$

28. If matrix $A=\begin{bmatrix}0&2b&-2\\3&1&3\\3a&3&-1\end{bmatrix}$ is a symmetric matrix, then the value of a is

A. $\frac{2}{3}$ B. $-\frac{2}{3}$ C. $\frac{3}{2}$ D. $-\frac{3}{2}$

29. For any matrix A, AA^T is a

A. Unit matrix B. Symmetric matrix C. Skew-symmetric matrix D. Diagonal matrix

30. If $adj A=\begin{bmatrix}2&5\\1&3\end{bmatrix}$, then inverse of the matrix A is

A. $\begin{bmatrix}2&5\\1&3\end{bmatrix}$ B. $\begin{bmatrix}-2&5\\1&-3\end{bmatrix}$ C. $\begin{bmatrix}3&-5\\-1&2\end{bmatrix}$ D. $\begin{bmatrix}2&-5\\-1&3\end{bmatrix}$

31. If $A=[a_{ij}]$ is a matrix of order 2×2, such that $|A|=-15$ and C_{ij} represents the cofactor of a_{ij}, then the value of $a_{21}C_{21}+a_{22}C_{22}$ is

A. 18 B. 15 C. 10 D. -15

32. The number of points of discontinuity of f defined by $f(x) = |x| - |x+1|$ is

A. 2 B. 0 C. 3 D. 4

33. Differentiation of $\log_x 4$ w.r.t. x is equal to

A. $\frac{\log 4}{x(\log x)^2}$ B. $-\frac{\log 4}{x(\log x)}$ C. $-\frac{\log 4}{x(\log x)^2}$ D. None of these

34. The slope of the tangent to the curve $x = t^2 + 3t - 8, y = 2t^2 - 2t - 5$ at the point $(2, -1)$ is

A. $\frac{22}{7}$ B. $\frac{6}{7}$ C. $\frac{7}{6}$ D. $-\frac{6}{7}$

35. The least value of the function $f(x) = ax + \frac{b}{x} (a > 0, b > 0, x > 0)$ is

A. $\sqrt{ab}$ B. $2\sqrt{ab}$ C. $\sqrt{a+b}$ D. none of these

36. Let the function $f: R \to R$ be defined by $f(x) = 2x + \cos x$, then f

A. has a minimum at $x = \pi$ B. has a maximum at $x = 0$ C. is a decreasing function D. is an increasing function

37. The maximum value of value of slope of the curve $y = -x^3 + 3x^2 + 12x - 5$ is

A. 15 B. 12 C. 9 D. 0

38. Maximum and minimum value of the function $f(x) = 3 - 2\sin x$ is respectively

A. 3 and 1 B. 4 and 3 C. 5 and 1 D. 4 and 2

39. The corner points of the feasible region determined by the system of linear constraints are $(2,4), (6,7), (0,8)$. Let $Z = 3x - 5y$ be the objective function. The difference between maximum and minimum value of Z is equal to

A. 26 B. 14 C. 17 D. 40

40. If $y^2 = ax^2 + bx + c$. Then $y^3 \frac{d^2y}{dx^2}$ is

A. constant B. function of x C. function of y D. None of these

SECTION-C

In this section, attempt any 8 questions. Each question is of 1 mark weightage. Questions 46-50 are based on a Case-Study.

41. For which value of m is the line $y = mx + 1$ a tangent to the curve $y^2 = 4x$?

A. $\frac{1}{2}$ B. 1 C. 2 D. 3

42. The maximum value of $[x(x-1)+1]^{\frac{1}{3}}, 0 \le x \le 1$ is:

A. 0 B. $\frac{1}{2}$ C. 1 D. $\sqrt[3]{\frac{1}{3}}$

43. The point which does not lie in the half-plane $2x + 3y - 12 \le 0$ is

A. (1,2) B. (2,1) C. (2,3) D. (−3,2)

44. In a linear programming problem, the constraints on the decision variables x and y are $x-3y\geq 0, y\geq 0, 0\leq x\leq 3$. The region

A. is not in the first quadrant B. is bounded in the first quadrant C. is bounded in the first quadrant D. does not exist

45. If A is a square matrix of order 3 such that $A(adj A) = \begin{bmatrix} -3 & 0 & 0 \\ 0 & -3 & 0 \\ 0 & 0 & -3 \end{bmatrix}, B = \begin{bmatrix} 1 & 0 & 0 \\ 7 & -1 & 0 \\ 5 & 2 & -2 \end{bmatrix}$, then the value of $|-2AB|$ is

A. 12 B. −1296 C. 48 D. −324

Cases-Studies

A cable network provider in a small town has 500 subscribers and he used to collect ₹300 per month from each subscriber. He proposes to increase the monthly charges and it is believed from past experience that for every increase in ₹1= one subscriber will discontinue the service.

Based on the above information, answer the following questions:

46. If ₹x is the monthly increase in subscription amount, then the number of subscriber are

A. x B. $500-x$ C. $x-500$ D. none of these

47. Total revenue 'R' is given by (in ₹)

A. $R=300x+300(500-x)$ B. $R=(300+x)(500+x)$ C. $R=(300+x)(500-x)$ D. $R=300x+500(x+1)$

48. $\frac{d^2R}{dx^2}$ is

A. 2 B. −2 C. 100 D. $a=-100$

49. What is increase in charges per subscriber that yields maximum revenue?

A. x=₹100 B. x=₹200 C. x=₹300 D. x=₹400

50. How would you conclude that the revenue generated is maximum?

A. By actually calculating revenue B. By using double derivative test which gives positive value C. By using double derivative test which gives negative value. D. None of above