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1st PRE-BOARD EXAMINATION SESSION 2021-22

MATEMATICS (041)

TERM -I

TIME ALLOWED: -90 Minutes **CLASS-XII** **MAXIMUM MARKS-40**

GENERAL INSTRUCIONS

1. This question paper contains **three sections-A, B, and C**. Each section is compulsory.

2. **Section –A has 20 MCQs**, attempt any **16 out of 20.**

3**. Section- B has 20 MCQs**, attempt any **16 out of 20.**

4**. Section- C has 10 MCQs**, attempt any **8 out of 10**

5. There is no negative marking.

SECTION A

In this section, attempt any 16 questions out of Questions 1-20
Each question is of 1-mark weightage.

Q.1. If $\theta = \sin^{-1}(\sin 600^\circ)$ then the value of θ is

(a) $\frac{\pi}{3}$ (b) $-\frac{\pi}{3}$ (c) 0 (d) $\frac{2\pi}{3}$

Q.2. The function given by $f(x) = \tan x$ is discontinuous on the set

(a) $\{x: x = 2n\pi, n \in Z\}$ (b) $\{x: x = (n-1)\pi, n \in Z\}$

(c) $\{x: x = n\pi, n \in Z\}$ (d) $\left\{x: x = (2n+1)\frac{\pi}{2}, n \in Z\right\}$

Q.3. If P and Q of symmetric matrix of same order then PQ − QP is a

(a) Zero matrix (b) Identity matrix

(c) Skew Symmetric matrix (d)Symmetric matrix

Q.4. The number of all possible matrices of order 3x3 with each entry 1 or 2 is

(a) 27 (b) 18 (c) 81 (d) 512

Q.5. The slope of the normal to the curve $y = 2x^2 + 3\sin x$ at $x = 0$ is

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

Q.6. Let A be a non-singular square matrix of order 3× 3. Then $|adjA|$ is equal to

(a) $|A|$ (b) $|A|^2$ (c) $|A|^3$ (d) $3|A|$

Q.7. Let R be the relation in the set $\{1, 2, 3, 4\}$ given by

$R = \{(1, 2), (2, 2), (1, 1), (4, 4), (1, 3), (3, 3), (3, 2)\}$ then R is

(a) reflexive and symmetric but not transitive.

(b) reflexive and transitive but not symmetric.

(c) symmetric and transitive but not reflexive.

(d) equivalence relation

Q.8. Which of the given values of x and y make the following pair of matrix equal.

$$\begin{bmatrix} 3x+7 & 5 \\ y+1 & 2-3x \end{bmatrix}, \begin{bmatrix} 0 & y-2 \\ 8 & 4 \end{bmatrix}.$$

(a) $x = -\frac{1}{3}$, $y = 7$ (b) Not possible to find.

(c) $x = -\frac{2}{3}$, $y = 7$ (d) $x = -\frac{1}{3}$, $y = -\frac{2}{3}$

Q.9. The tangent to the curve $y = e^{2x}$ at the point (0, 1) meets x-axis at

(a) (0, 1) (b) (0, 2) (c) $\left(-\frac{1}{2}, 0\right)$ (d) (2, 0)

Q.10. $\tan^{-1}\sqrt{3} - \sec^{-1}(-2)$ is equal to

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

Q.11. If R is a relation from A to B, then

(a) $R \subset A$ (b) $R \subset B$ (c) $R \subset A \times B$ (d) none of these

Q.12. If $x = e^{y+e^{y+\cdots\ldots\ldots to\ \infty}}$, $x > 0$, then $\frac{dy}{dx}$ is

(a) $\frac{1}{x}$ (b) $\frac{x}{1+x}$ (c) $\frac{1-x}{x}$ (d) none of these

Q.13. If Y, W, and P are matrices of order 3× k, n × 3, p × k respectively. The restriction on n, k, and p so that PY+WY will be defined are

(a) k = 3 , p = n (b) k is arbitrary, p = 2

(c) p is arbitrary, k = 3 (d) k = 2, p = 3

Q.14. The derivative of $\sin(\log x)$ w.r.t. x is

(a) $\frac{\sin(\log x)}{x}$ (b) $-\frac{\cos(\log x)}{x}$ (c) $\frac{\cos(\log x)}{x}$ (d) none of these

Q.15. Let A be a square matrix of order 3× 3, then |kA| is equal to

(a) k |A| (b) k^2|A| (c) k^3|A| (d) 3k |A|

Q.16. The two curve $x^3 - 3xy^2 + 2 = 0$ and $3x^2y - y^3 = 2$

(a) touch each other (b) cut at an angle $\frac{\pi}{3}$

(c) cut at right angle (d) cut at an angle $\frac{\pi}{6}$

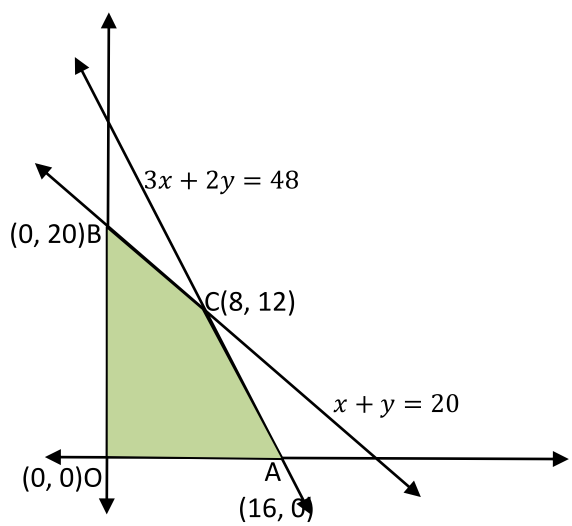
Q.17. If matrix A = $[a_{ij}]_{2x2}$,where $a_{ij} = 1, if$ i ≠ jand $a_{ij} = 0$, if i = j, then A^2 is equal to

(a) I (b) A (c) 0 (d) None of these.

Q.18. If $e^y(x + 1) = 1$, then $\frac{d^2y}{dx^2}$ is equal to

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

Q.19. Based on the given shaded region as the feasible region in the graph, at which point(s) is the objective function Z = $22x + 18y$ maximum?



(a)Point A (b) point B (c) Point C (d) Point O

Q.20. The function $f(x) = x^2 - x + 1$ in $(-1, 1)$ is

(a) increasing (b) decreasing

(c) neither increasing nor decreasing (d) none of these

SECTION B

In this section, attempt any 16 questions out of Questions 21-40

Each question is of 1-mark weightage.

Q.21. Let $f: R \to R$ be defined as $f(x) = x^4$ is

(a) f is one-one onto (b) f is many one onto.

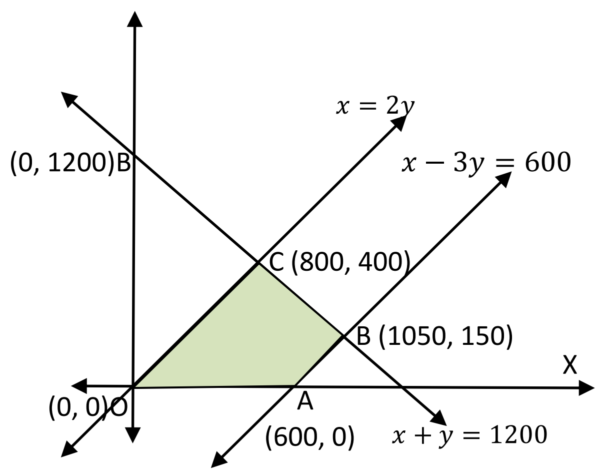
(c) f is one-one but not onto (d) f is neither one-one nor onto.

Q.22. If $x = a\cos^3\theta$ and $y = a\sin^3\theta$, then find the value of $\frac{dy}{dx}$ at $\theta = \frac{\pi}{4}$.

(a) 1 (b) 0 (c) -1 (d) $-\infty$

Q.23. In the given graph, the feasible reason for a LPP is shaded. The objective function Z = $12x + 16y$, will be maximum at

(a)Point A (b) point B (c) Point C (d) Point O



Q.24. The derivative of $\tan^{-1}\left(\frac{\sqrt{1+x^2}-1}{x}\right)$ with respect to $\tan^{-1}x$, when $x \neq 0$ is

(a) 1 (b) 0 (c) -1 (d) $\frac{1}{2}$

Q.25. If $[1 \quad x \quad 1]\begin{bmatrix} 1 & 3 & 2 \\ 2 & 5 & 1 \\ 15 & 3 & 2 \end{bmatrix}\begin{bmatrix} 1 \\ 2 \\ x \end{bmatrix} = 0$, then value x is/are

(a) $-2, -14$ (b) 14 (c) 2 (d) $\frac{1}{2}$

Q.26. The function $f(x) = 2x^2 - 3x$ is

(a) Strictly increasing on $(0, \infty)$

(b) Strictly increasing on $\left(\frac{3}{4}, 6\right)$, Strictly decreasing on $(-\infty, 1)$

(c) Strictly increasing on $\left(\frac{3}{4}, \infty\right)$, Strictly decreasing on $\left(-\infty, \frac{3}{4}\right)$

(d) none of these

Q.27. Simplest form of $\cot^{-1}\left(\frac{\sqrt{1+\sin x}+\sqrt{1-\sin x}}{\sqrt{1+\sin x}-\sqrt{1-\sin x}}\right)$**,** $\boldsymbol{x} \in \left(\mathbf{0}, \frac{\boldsymbol{\pi}}{\mathbf{4}}\right)$ is

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

Q.28. If A = $\begin{bmatrix} 1 & 2 \\ 4 & 2 \end{bmatrix}$, then true statement is

(a) $|2A| = 4|A|$ (b) $|2A| = 2|A|$

(c) $|2A| = |A|$ (d) none of these

Q.29. If $f(x) = \frac{1}{4x^2+2x+1}$, then its maximum value is

(a) 0 (b) $\frac{4}{3}$

(c) ± 5 (d) Maximum value does not exist.

Q.30. Let R be the relation in the set N given by R = $\{(a, b): a = 2b \text{ and } a \geq 3\}$, then

(a) $(2, 4) \in R$ (b) $(8, 4) \in R$

(c) $(4, 10) \in R$ (d) $(4, 8) \in R$

Q.31. The function defined by

$f(x) = |x - 1|, \; x \in R$ is not differentiable at point(s)

(a) $x \in R$ (b) $x = 1, -1$

(c) $x = 1$ (d) $x \in R - \{1\}$

Q.32. If A = $\begin{bmatrix} 1 & 1 & 1 \\ 1 & 1 & 1 \\ 1 & 1 & 1 \end{bmatrix}$, then A^2 is

(a) 27 A (b) 2 A (c) 3 A (d) I

Q.33. A linear programming problem is as follows:

Maximize Z = $3x + 2y$

subject to constraints: $x + 2y \leq 10, \; 3x + y \leq 15, \; x \geq 0, \; y \geq 0$

In the feasible region, the maximum value of Z is occurs at

(a) $x = 2, y = 3$.

(b) $x = 3, y = 4$.

(c) $x = 4, y = 3$.

(d) no points

Q.34. The interval in which the function f given by $f(x) = 2x^3 - 3x^2 - 36x + 7$ is Strictly decreasing is

(a) $(-\infty, -2)$ (b) $(-2, 3)$

(c) $(3, \infty)$ (d) $(-\infty, -2) \cup (3, \infty)$

Q.35. If A = $\begin{bmatrix} \alpha & \beta \\ \gamma & \delta \end{bmatrix}$ is such that A^2 = I(identity matrix) then

(a) $1+\alpha^2 + \beta\gamma = 0$ (b) $1-\alpha^2 + \beta\gamma = 0$

(c) $1-\alpha^2 - \beta\gamma = 0$ (d) $1+\alpha^2 - \beta\gamma = 0$

Q.36. The value of $\sin(2\sin^{-1}(.8))$ is

(a) $\sin 1.6$ (b) 1.6 (c) .96 (d) 4.8

Q.37. Let $f: R \to R$ be defined by $f(x) = x^2 + 1$. Then, pre-image of 5 is/are

(a) -3 (b) $-2, 2$

(c) $-1, 2$ (d) none of these

Q.38. If A = $\begin{bmatrix} \cos\alpha & -\sin\alpha \\ \sin\alpha & \cos\alpha \end{bmatrix}$ then $A+A^T$ = I, if the value of α is

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

Q.39. The values of a for which $y = x^2 + ax + 25$ touches the x-axis are

(a) 0 (b) ± 10 (c) $4, -6$ (d) ± 5

Q.40. If matrix A = $[a_{ij}]_{2x2}$,where $a_{ij} = 1, if$ i ≠ jand $a_{ij} = 0$, if i = j, then A^2 is equal to

(a) I (b) A (c) 0 (d) None of these.

SECTION C

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

Q.41. For an objective function Z =$ax + by$, where $a, b > 0$; the corner points of the feasible region determined by a set of constraints are (60, 0), (120, 0), (60, 30) and (40, 20). The condition on a and b such that the maximum Z occurs at both the points (120, 0) and (60, 30) is

(a) $a - 2b = 0$ (b) $2a - 3b = 0$

(c) $2a - b = 0$ (d) $a - b = 0$

Q.42. The line $y = x + 1$ is a tangent to the curve $y^2 = 4x$ at the point

(a) (1, 2) (a) (2, 1) (a) $(1, -2)$ (a) (-1, 2)

Q.43. The function given by $f(x) = x^3 - 3x^2 + 3x - 100$ is

(a) strictly increasing in R (b) strictly decreasing in R

(c) neither increasing nor decreasing in R (d) not define in R

Q.44. In a linear programming problem, the constraint on the decision variable x and y are $x + 2y \leq 8,\ 3x + 2y \leq 12,\ x \geq 0,\ y \geq 0$. The feasible region is

(a)is not in the first quadrant (b) is bounded in the first quadrant

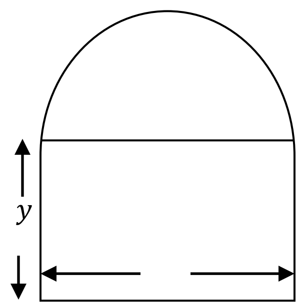
(c) is unbounded in the first quadrant (d) does not exist

Q.45. If $\begin{vmatrix} x & 2 \\ 18 & x \end{vmatrix} = \begin{vmatrix} 6 & 2 \\ 18 & 6 \end{vmatrix}$ then x is equal to

(a) 6 (b) $\pm$ 6 (c) $-$ 6 (d) 0

<u>CASE STUDY</u>

Dr. Ritam residing in Delhi went to see an apartment of 3 BHK in Dilshad Garden. The window of the house was in the form of a rectangle surmounted by a semicircular opening having a perimeter of the window 10 m. as show in figure.



Based on the above information answer the following:

Q.46. If x and y represent the length and breadth of the rectangular region, then the relation between the variable is

(a) $x + y + \frac{x}{2} = 10$

(b) $x + y + \frac{x}{2} = 10$

(c) $2x + 4y + \pi x = 20$

(d) $x + y + \frac{x}{2} = 10$

Q.47. The area **A**of the window is expressed as a function of x is

(a) A = $x - \frac{x^2}{2} - \frac{\pi x^2}{8}$

(b) A = $5x - \frac{3x^2}{2} - \frac{\pi x^2}{8}$

(c) A = $5x + \frac{x^2}{2} - \frac{\pi x^2}{8}$

(d) A = $5x - \frac{x^2}{2} - \frac{\pi x^2}{8}$

Q.48. Dr. Ritam is interested in maximizing the area of the whole window. For this to happen the value of length$x$ should be

(a) $\frac{20}{4+\pi}$ m

(b) $\frac{20}{\pi}$ m

(c) $\frac{20}{2+\pi}$ m

(d) $\frac{20}{4-\pi}$ m

Q.49. For maximum value of A, the breadth $y$of rectangular part of window is

(a) $\frac{10}{4+\pi}$ m

(b) $\frac{10}{\pi}$ m

(c) $\frac{20}{2+\pi}$ m

(d) $\frac{10}{4-\pi}$ m

Q.50. The maximum area of window is

(a) $\frac{200}{(4+\pi)^2}$ sq. m

(b) $\frac{100}{(4+\pi)^2}$ sq. m

(c) $\frac{200+5\pi}{(4-\pi)^2}$ sq. m

(d) $\frac{200+50\pi}{(4+\pi)^2}$ sq. m