CLASS – XII (TEST PAPER-9)

MATHEMATICS (CODE-041) TERM - 1

Time : 90 MINUTESs **Maximum Marks : 40**

General Instructions:

1. This question paper contains three sections – A, B and C. Each part 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.
6. All questions carry equal marks.

SECTION – A

In this section, attempt any 16 questions out of Questions 1 – 20. Each Question is of 1 mark weightage. In case more than desirable number of questions are attempted, ONLY first 16 will be considered for evaluation.

Q.1 $\sin\left[\frac{\pi}{2} - \sin^{-1}\left(-\frac{\sqrt{3}}{2}\right)\right] =$

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

Q.2 If $f(x) = \begin{cases} \frac{1-\cos 4x}{x^2}, & \text{when } x < 0 \\ a, & \text{when } x = 0 \\ \frac{\sqrt{x}}{\sqrt{(16+\sqrt{x})}-4}, & \text{when } x > 0 \end{cases}$, is continuous at $x = 0$, then the value of 'a' will be

(a) 8 (b) – 8 (c) 4 (d) None of these

Q.3 Which of the following statement is false

(i) Adjoint of a symmetric matrix is symmetric,

(ii) Adjoint of a unit matrix is a unit matrix,

(iii) $A(adj\,A) = (adj\,A)\ A = |A|\,I$ and

(iv) Adjoint of a diagonal matrix is a diagonal matrix, is/are incorrect

(a)(i) (b)(ii)(c)(iii) and (iv)(d) None of these

Q.4 If A is a square matrix of order 3 such that A(adj A) = 4I,then $adj\left(adj\ A\right) =$

(a) 4A (b)4A(c)16A(d) NONE

Q.5 $f(x) = x^3 - 27x + 5$ is an increasing function, when

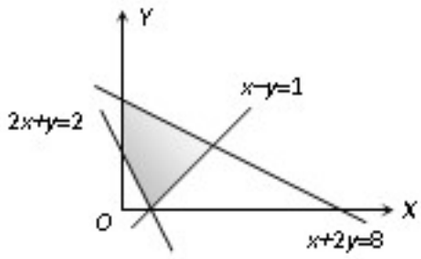
(a) $x < -3$ (b) $|x| > 3$ (c) $x \le -3$ (d) $|x| < 3$

Q.6 If $A = \begin{bmatrix} 1 \\ 2 \\ 3 \end{bmatrix}$, then $AA' =$

(a) 14 (b) $\begin{bmatrix} 1 \\ 4 \\ 3 \end{bmatrix}$ (c) $\begin{bmatrix} 1 & 2 & 3 \\ 2 & 4 & 6 \\ 3 & 6 & 9 \end{bmatrix}$ (d) None of these

Q.7 Let A = {1, 2, 3…… 12} and R be the relation in $A \times A$ defined by

	$(a,b)R(c,d) \Leftrightarrow ad = bc$ for (a, b), (c, d) $\in A \times A$. Then the number of equivalence class [(2, 4)] (A) 9 (B) 8 (C) 6 (D) none of these
Q.8	If A is a square matrix of order 3 × 3 such that |A| = 3, then |A(adj A)| = (a)3 (b)9(c)27(d) none
Q.9	The angle of intersection of curves $y = x^2$, $6y = 7 - x^3$ at (1, 1) is (a) $\pi/4$ (b) $\pi/3$ (c) $\pi/2$ (d) π
Q.10	$\sec^{-1}\left(-\sqrt{2}\right) \in [3\pi, 4\pi] - \{7\pi/2\} = -----$ (a) $\frac{11\pi}{4}$ (b) $\frac{15\pi}{4}$ (c) $\frac{13\pi}{4}$ (d)None of these
Q.11	Relation $R = \{(x,y) \in w \times w : y = 2x - 4\}$. $(4, b^2)$ belong to relation R, find the value b (A) 2 (B) - 2 (C) ± 2 (D) None of these
Q.12	If $\cos(x+y) = y \sin x$, then $\frac{dy}{dx} =$ (a) $-\frac{\sin(x+y) + y\cos x}{\sin x + \sin(x+y)}$ (b) $\frac{\sin(x+y) + y\cos x}{\sin x + \sin(x+y)}$ (c) $\frac{y\cos x - \sin(x+y)}{\sin x - \sin(x+y)}$ (d) None of these
Q.13	Let $A = \begin{bmatrix} 1 & 2 & 2 \\ 2 & 1 & 2 \\ 2 & 2 & 1 \end{bmatrix}$, then a. $A^2 - 4A - 5I_3 = 0$ b. $A^{-1} = \frac{1}{5}(A - 4I_3)$ c. Both a and b. d. None of these
Q.14	If $y = \left[\log\left(x + \sqrt{x^2+1}\right)\right]^2$, prove that $\left(1 + x^2\right)\frac{d^2y}{dx^2} + x\frac{dy}{dx} =$ (a) 2 (b) 2y (c) -2y (d) NONE
Q.15	A is a orthogonal matrix then Write the value of $\lvert A \rvert =$ **(a) -1 (b)1(c) ± 1 (d) none**
Q.16	If the normal to the curve $y^2 = 5x - 1$, at the point (1, –2) is of the form $ax - 5y + b = 0$, then a and b are (a) 4, – 14 (b) 4, 14 (c) –4, 14 (d) –4, –14
Q.17	If $A = \begin{bmatrix} 1 & 2 & 3 \\ -2 & 3 & -1 \\ 3 & 1 & 2 \end{bmatrix}$ and I is the unit matrix of 3rd order, then $\left(A^2 + 9I\right) =$ **(a)** $2A$ **(b)** $4A$ **(c)** $6A$ **(d)** None of these
Q.18	The derivative of $\sin^2 x$ with respect to $\cos^2 x$ is (a) $\tan^2 x$ (b) $\tan x$ (c) $-\tan x$ (d) None of these
Q.19	For the following shaded area, the linear constraints except $x \geq 0$ and $y \geq 0$, are



(a) $2x + y \le 2,\ x - y \le 1,\ x + 2y \le 8$

(b) $2x + y \ge 2,\ x - y \le 1,\ x + 2y \le 8$

(c) $2x + y \ge 2,\ x - y \ge 1,\ x + 2y \le 8$

(d) $2x + y \ge 2,\ x - y \ge 1,\ x + 2y \ge 8$

Q.20 A given rectangle area is to be fenced off , in a field whose length lies along the river . The least length will be required when

(a) length of the field is twice its breadth

(b) length of the field is thrice its breadth

(c) length of the field is half its breadth

(d) none of these .

SECTION – B

In this section, attempt any 16 questions out of the Questions 21 - 40. Each Question is of 1 mark weightage. **In case more than desirable number of questions are attempted, ONLY first 16 will be considered for evaluation.**

Q.21 Set A has 3 elements and set B has 4 elements. The number of injection that can be defined from A to B is

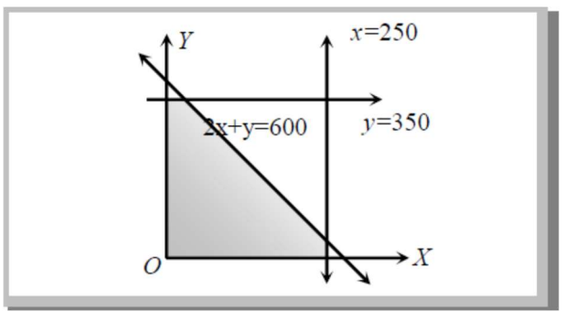
(a) 144 (b) 12(c) 24 (d) 64

Q.22 The differential equation satisfied by the function $y = \sqrt{\sin x + \sqrt{\sin x + \sqrt{\sin x + ...\infty}}}$, is

(a) $(2y-1)\frac{dy}{dx} - \sin x = 0$ (b) $(2y-1)\cos x + \frac{dy}{dx} = 0$

(c) $(2y-1)\cos x - \frac{dy}{dx} = 0$ (d) $(2y-1)\frac{dy}{dx} - \cos x = 0$

Q.23 For the following feasible region, the linear constraints except $x \ge 0$ and $y \ge 0$, are

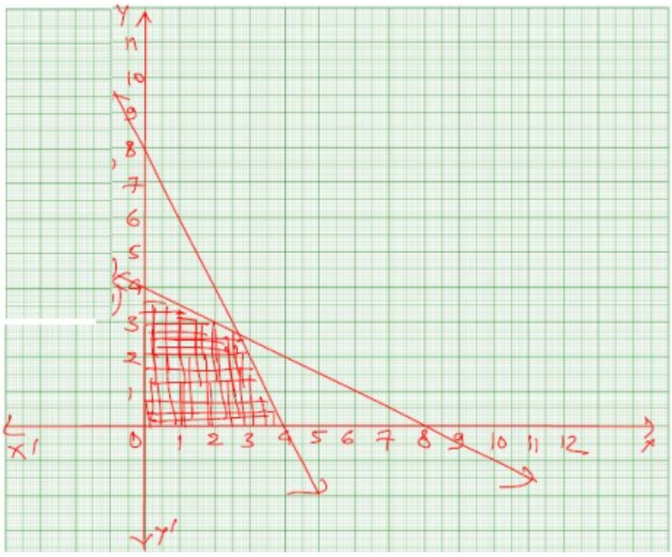


(a) $x \ge 250,\ y \le 350, 2x + y = 600$ (b) $x \le 250,\ y \le 350, 2x + y = 600$

(c) $x \le 250,\ y \le 350, 2x + y \ge 600$ (d) $x \le 250,\ y \le 350, 2x + y \le 600$

Q.24 $\frac{d}{dx}\left(\cos^{-1}\sqrt{\frac{1+\cos x}{2}}\right) =$

(a) 1 (b) $\frac{1}{2}$ (c) $\frac{1}{3}$ (d)None of these

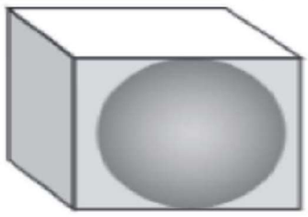
Q.25	If $A=\begin{pmatrix}2 & 1 & -1\\ 1 & -1 & 1\\ 3 & 1 & -2\end{pmatrix}$, then find the value of $\lvert 4AI \rvert$ **(a) 48 (b)64(c)192(d) none**
Q.26	The function $f(x)=2\log(x-2)-x^2+4x+1$ increases in the interval (a) $(1,2)$ (b) $(2,3)$ (c) $(-\infty,-1)$ (d)$(2,4)$
Q.27	The least value $(\sin^{-1}x)^2+(\cos^{-1}x)^2$ when x = (a) $\frac{1}{\sqrt{2}}$ (b) $-\frac{1}{\sqrt{2}}$ (c) 1 (d)None of these
Q.28	If A and B be square matrices of the same order, then $AB - BA$ will be a (a) Symmetric matrix (b) Skew-symmetric matrix (c) Null matrix (d) None of these
Q.29	The interval in which $f(x)=\frac{4\sin x-2x-x\cos x}{2+\cos x}$ on $(0,2\pi)$ is increasing (a) $\left(0,\frac{\pi}{2}\right)$ (b) $\left(\frac{3\pi}{2},2\pi\right)$ (c) a and b both (d) none
Q.30	Let A = {1, 2, 3}. Then number of equivalence relations containing **(1,2)** is: a. 1 b. 2 c.3 d.4
Q.31	If function $f(x)=\lvert x-3\rvert+\lvert x-4\rvert$, then which statement is true **(a)**f(x) is differentiable at x = 3 **(b)** f(x) is differentiable at x = 4 **(c)** f(x) is not differentiable at x =3 & 4 **(d)** none
Q.32	If A, B, C are three $n\times n$ matrices, then $(ABC)'$ = (a) $A'B'C'$ (b) $C'B'A'$ (c) $B'C'A'$ (d) $B'A'C'$
Q.33	 $(i)\ x+2y\le 8$ $(ii)\ x\ge 0,\ y\ge 0$ $(iii)\ x\le 0,\ y\le 0$ $(iv)\ 2x+y\le 8$ $(v)\ 4x+5y\le 40$ $(a)\ (i),(iii)\ \&\ (v)$ $(b)\ (i),(iv)\ \&\ (v)$ $(c)\ (i),(iii)\ \&\ (iv)$ $(d)\ (i),(ii)\ \&\ (iv)$
Q.34	The minimum value of (ax + by), where $xy = c^2$

	(a) $c\sqrt{ab}$ (b) $2c\sqrt{ab}$ (c) $2\sqrt{abc}$ (d) none .
Q.35	If $\begin{bmatrix} 1/25 & 0 \\ x & 1/25 \end{bmatrix} = \begin{bmatrix} 5 & 0 \\ -a & 5 \end{bmatrix}^{-2}$ then the value of x is : a. $\frac{a}{125}$ b. $\frac{2a}{25}$ c. $\frac{2a}{125}$ d. None of these
Q.36	$\cos^{-1}\left(\frac{2^{x+1}}{1+4^x}\right) = ------$ **(a)** $2\tan^{-1}(2^x)$ **(b)** $\frac{\pi}{2}+2\tan^{-1}(2^x)$ **(c)** $\frac{\pi}{2}-2\tan^{-1}(2^x)$ **(d)None of these**
Q.37	If $A=\begin{bmatrix} 4 & 6 & -1 \\ 3 & 0 & 2 \\ 1 & -2 & 5 \end{bmatrix}, B=\begin{bmatrix} 2 & 4 \\ 0 & 1 \\ -1 & 2 \end{bmatrix}$ and $C=\begin{bmatrix} 3 & 1 & 2 \end{bmatrix}$. The expression which is not defined is (a) $B'B$ (b) CAB (c) $A+B'$ (d) A^2+A
Q.38	Let N be the set of natural numbers and the function f:N$\to$N be defined by $f(n) = 2n + 3 \forall n \in N$. Then f is : a. surjective b. injective c. bijective d. None of these
Q.39	The equation of the tangent to the curve $x = 2\cos^3\theta$ and $y = 3\sin^3\theta$ at the point $\theta = \pi/4$ is (a) $2x+3y=3\sqrt{2}$ (b) $2x-3y=3\sqrt{2}$ (c) $3x+2y=3\sqrt{2}$ (d) $3x-2y=3\sqrt{2}$
Q.40	If $M=\begin{bmatrix} 1 & 2 \\ 2 & 3 \end{bmatrix}$ and $M^2-\lambda M-I_2=0$, then $\lambda =$ (a) -2 (b) 2 (c) -4 (d) 4

SECTION – C

In this section, attempt any 8 questions. Each question is of 1-mark weightage. Questions 41-50 are based on a Case-Study. In case more than desirable number of questions are attempted, ONLY first 8 will be considered for evaluation.

Q.41	The equation of the tangent to curve $y = be^{-x/a}$ at the point where it crosses y-axis is (a) $ax+by=1$ (b) $ax-by=1$ (c) $\frac{x}{a}-\frac{y}{b}=1$ (d) $\frac{x}{a}+\frac{y}{b}=1$
Q.42	A linear programming problem is as follows: $Minimize\ Z = 30x + 50y$ subject to the constraints, $3x + 5y \geq 15$ $2x + 3y \leq 18$ $x \geq 0$, $y \geq 0$ In the feasible region, the minimum value of Z occurs at a) a unique point b) no point c) infinitely many points d) two points only
Q.43	The function $\sin x(1+\cos x)$ at $x = \frac{\pi}{3}$, is (a) Maximum (b) Minimum (c) Neither maximum nor minimum(d)None of these
Q.44	For an objective function $Z = ax + by$, where a, $b > 0$; the corner points of the feasible region determined by a set of constraints (linear inequalities) are (0, 20), (10, 10), (30, 30) and (0, 40). The condition on a and b such that the maximum Z occurs at both the points (30, 30) and (0, 40) is: a) $b - 3a = 0$ b) $a = 3b$ c) $a + 2b = 0$ d) $2a - b = 0$

Q.45	If -9 is a root of the equation $\begin{vmatrix} x & 3 & 7 \\ 2 & x & 2 \\ 7 & 6 & x \end{vmatrix} = 0$ then the other two roots are (a) 2, 7 (b) $-2, 7$ (c) $2, -7$ (d) $-2, -7$
	CASE STUDY-7 Shreya got a rectangular parallelopiped shaped box and spherical ball inside it as return gift. Sides of the box are x, $2x$ and $x/3$, while radius of the ball is r.  Based on the above information, answer the following questions.
Q.46	If S represents the sum of volume of parallelopiped and sphere, then S can be written as (a) $\frac{4x^3}{3}+\frac{2}{2}\pi r^2$ (b) $\frac{2x^2}{3}+\frac{4}{3}\pi r^2$ (c) $\frac{2x^3}{3}+\frac{4}{3}\pi r^3$ (d) $\frac{2}{3}x+\frac{4}{3}\pi r$
Q.47	If sum of the surface areas of the box and ball are given to be constant k^2, then x is equal to (a) $\sqrt{\frac{k^2-4\pi r^2}{6}}$ (b) $\sqrt{\frac{k^2-4\pi r}{6}}$ (c) $\sqrt{\frac{k^2-4\pi}{6}}$ (d) None of these
Q.48	The radius of the ball, when S is minimum, is (a) $\sqrt{\frac{k^2}{54+\pi}}$ (b) $\sqrt{\frac{k^2}{54+4\pi}}$ (c) $\sqrt{\frac{k^2}{64+3\pi}}$ (d) $\sqrt{\frac{k^2}{4\pi+3}}$
Q.49	Relation between length of the box and radius of the ball can be represented as (a) $x=2r$ (b) $x=\frac{r}{2}$ (c) $x=\frac{r}{2}$ (d) $x=3r$
Q.50	Minimum value of S is (a) $\frac{k^2}{2(3\pi+54)^{2/3}}$ (b) $\frac{k}{(3\pi+54)^{3/2}}$ (c) $\frac{k^3}{3(4\pi+54)^{1/2}}$ (d) None of these
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