PACE GROUP

المدرسة الهندية الدولية ذ.م.م
INDIA INTERNATIONAL SCHOOL LLC - SHARJAH

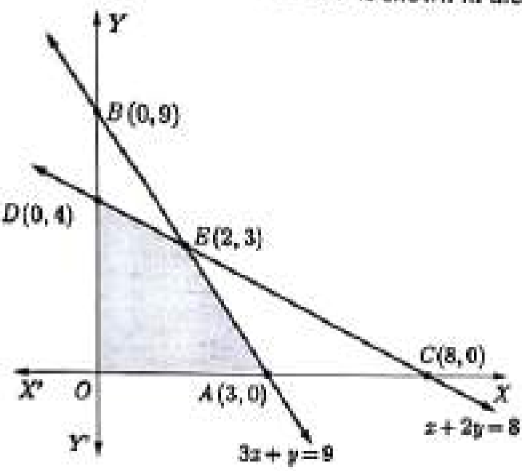
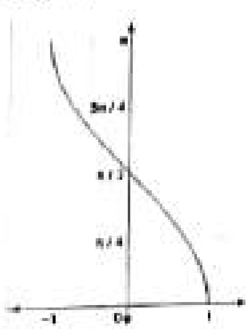
Grade: 12 **Section:** C	**MODEL-I EXAMINATION, SESSION:2024-25**	**Max Marks: 80**
Date:16 -12 -2024	**MATHEMATICS - SET A** **(041)**	**Max.Time:3Hours**

Name: RAFIA **Roll no:** 27

General Instructions:

1. This Question paper contains - five sections A, B, C, D and E. Each section is compulsory. However, there are internal choices in some questions.
2. Section A has 18 MCQ's and 02 Assertion-Reason based questions of 1 mark each.
3. Section B has 5 Very Short Answer (VSA)-type questions of 2 marks each.
4. Section C has 6 Short Answer (SA)-type questions of 3 marks each.
5. Section D has 4 Long Answer (LA)-type questions of 5 marks each.
6. Section E has 3 source based/case based/passage based/integrated units of assessment (4 marks each) with sub parts.

Q.No.	SECTION A	Marks
	Section A consists of 20 questions of 1 mark each	
1.	If A is a matrix of order 3 such that A (adj A) = 10 I, then |adj A |is equal to (a) 1 (b) 10 (c) 100 (d) 10 I	1
2.	If A and B are square matrices of the same order, then $(A+B)(A-B)$ is equal to (a) A^2-B^2 (b) $A^2-BA+AB-B^2$ (c) $A^2-B^2+BA-AB$ (d) A^2-AB+B^2+AB	1
3.	The function f (x) = x^2, for all real x, is (a) decreasing (b) increasing (c) neither decreasing nor increasing (d) none of the above	1
4.	If A and B are invertible matrices, then which of the following is not correct? (a) $\text{adj } A = \|A\|.A^{-1}$ (b) $\det(A)^{-1} = [\det(A)]^{-1}$ (c) $(AB)^{-1} = B^{-1}A^{-1}$ (d) $(A+B)^{-1} = B^{-1}+A^{-1}$	1
5.	The order of the differential equation $\frac{d^4y}{dx^4} - \sin\left(\frac{d^2y}{dx^2}\right) = 5$ is: (a) 4 (b) 3 (c) 2 (d) not defined	1
6.	The vectors $\vec{a} = 2\hat{i} - \hat{j} + \hat{k}$, $\vec{b} = \hat{i} - 3\hat{j} - 5\hat{k}$ and $\vec{c} = -3\hat{i} + 4\hat{j} + 4\hat{k}$ represents the sides of (a) an equilateral triangle (b) an obtuse- angled triangle (c) an isosceles triangle (d) a right- angled triangle	1
7.	If A= $\begin{bmatrix} 1 & 4 & x \\ z & 2 & y \\ -3 & -1 & 3 \end{bmatrix}$ is a symmetric matrix, then the value of x + y + z is (a) 10 (b) 6 (c) 8 (d) 0	1

8.	Let E and F be two events such that P(E) = 0.1, P(F) = 0.3, P (E ∪ F) = 0.4, then P(F/E) is: (a) 0.6 (b) 0.4 (c) 0.5 (d) 0	1
9.	$\begin{vmatrix} x+1 & x-1 \\ x^2+x+1 & x^2-x+1 \end{vmatrix}$ is equal to: (a) $2x^3$ (b) 2 (c) 0 (d) $2x^3 - 2$	1
10.	If $\lvert\vec{a}\rvert = 3$, $\lvert\vec{b}\rvert = 4$ and $\lvert\vec{a} + \vec{b}\rvert = 5$, then $\lvert\vec{a} - \vec{b}\rvert =$ (a) 3 (b) 4 (c) 5 (d) 8	1
11.	The feasible solution for an LPP is shown in the following figure.  Let P = 40 x + 50 y be the objective function. Maximum of P occurs at (a) (3, 0) (b) (2,3) (c) (0, 4) (d) (0, 0)	1
12.	$\int_2^3 \frac{x}{x^2+1}\,dx$ is (a) log 4 (b) $\log\frac{3}{2}$ (c) $\frac{1}{2}\log 2$ (d) $\log\frac{9}{4}$	1
13.	$\int_0^{2\pi} cosec^7 x\,dx$ is equal to (a) 0 (b) 1 (c) 4 (d) 2π	1
14.	The integrating factor of the differential equation $(x + 2y^2)\frac{dy}{dx} = y$ $(y > 0)$ is : (a) $\frac{1}{x}$ (b) x (c) y (d) $\frac{1}{y}$	1
15.	The graph drawn below depicts  (a) $y = \cot^{-1}x$ (b) $y = cosec^{-1}x$ (c) $y = \cos^{-1}x$ (d) $y = \sin^{-1}x$	1

16.	The number of corner points of the feasible region determined by constraints $x \geq 0$, $y \geq 0$, $x + y \geq 4$ is: (a) 0 (b) 1 (c) 2 (d) 3	1
17.	The function $f(x) = e^{\lvert x \rvert}$ is (a) Continuous everywhere but not differentiable at $x = 0$ (b) Continuous and differentiable everywhere (c) Not continuous at $x = 0$ (d) None of these	1
18.	A student observes an open-air Honeybee nest on the branch of a tree, whose plane figure is parabolic shape given by $x^2 = 4y$. Then the area (in sq units) of the region bounded by parabola $x^2 = 4y$ and the line $y = 4$ is (a) $\frac{32}{3}$ (b) $\frac{64}{3}$ (c) $\frac{128}{3}$ (d) $\frac{256}{3}$	1
19.	**DIRECTION:** In question number 19 and 20, a statement of **assertion (A)** is followed by a statement of **Reason (R)**. Choose the correct option. Assertion (A): The function $f(x) = \frac{\lvert x \rvert}{x}$ is continuous at $x = 0$. Reason (R): The left-hand limit and right-hand limit of the function $f(x) = \frac{\lvert x \rvert}{x}$ are not equal at $x = 0$. (a) Both A and R are true and R is the correct explanation of A. (b) Both A and R are true but R is not the correct explanation of A. (c) A is true but R is false. (d) A is false but R is true.	1
20.	Assertion (A): The function $f: R - \left\{(2n+1)\frac{\pi}{2} : n\epsilon Z\right\} \to (-\infty, -1] \cup [1, \infty)$ defined by $f(x) = \sec x$ is not one-one function in its domain. Reason (R): The line $y = 2$ meets the graph of the function at more than one point. (a) Both A and R are true, and R is the correct explanation of A. (b) Both A and R are true, but R is not the correct explanation of A. (c) A is true but R is false. (d) A is false but R is true.	1
	SECTION B	
	Section B consists of 5 questions of 2 marks each.	
21.	Find the value of k if $\sin^{-1}[k \tan (2 \cos^{-1} \frac{\sqrt{3}}{2})] = \frac{\pi}{3}$.	2
22.	The volume of a cube is increasing at the rate of 6 cm^3/s. How fast is the surface area of cube increasing, when the length of an edge is 8 cm?	2
23.	(a) If $x = e^{\frac{x}{y}}$, prove that $\frac{dy}{dx} = \frac{\log x - 1}{(\log x)^2}$ **OR** (b) Check the differentiability of $f(x) = \begin{cases} x^2 + 1, & 0 \leq x < 1 \\ 3 - x, & 1 \leq x \leq 2 \end{cases}$ at $x = 1$	2
24.	(a) If vectors $\vec{a} = 2\hat{i} + 2\hat{j} + 3\hat{k}$, $\vec{b} = -\hat{i} + 2\hat{j} + \hat{k}$ and $\vec{c} = 3\hat{i} + \hat{j}$ are such that $\vec{b} + \lambda\ \vec{c}$ is perpendicular to $\vec{a}$, then find the value of λ. **OR**	2

	(b) A person standing at O (0,0,0) is watching an aeroplane which is at coordinate point A (4, 0, 3). At the same time he saw a bird at the coordinate point B (0,0,1). Find the angles which $\overrightarrow{BA}$ makes with the x, y and z axes.	
25.	Find the vector equation of the line passing through the point $A(1, 2, -1)$ and parallel to the line $5x - 25 = 14 - 7y = 35z$.	2
	SECTION C	
	Section C consists of 6 questions of 3 marks each.	
26.	Find the absolute maximum and absolute minimum values of the function f given by $f(x) = \frac{x}{2} + \frac{2}{x}$ on the interval $[1,2]$.	3
27.	Find the particular solution of the differential equation $(x\, e^{\frac{y}{x}} + y)\, dx = x\, dy$, given that y = 1 when x = 1.	3
28.	(a) If $\vec{a} = \hat{i} + \hat{j} + \hat{k}$ and $\vec{b} = \hat{j} - \hat{k}$, then find a vector $\vec{c}$, such that $\vec{a} \times \vec{c} = \vec{b}$ and $\vec{a} \cdot \vec{c} = 3$. **OR** (b) If $\vec{a} = \hat{i} - \hat{j} + 7\hat{k}$ and $\vec{b} = 5\hat{i} - \hat{j} + \lambda\hat{k}$, then find the value of λ, so that $\vec{a} + \vec{b}$ and $\vec{a} - \vec{b}$ are perpendicular vectors.	3
29.	(a) Evaluate: $\int \left\{\frac{1}{\log x} - \frac{1}{(\log x)^2}\right\} dx$; (where $x > 1$). **OR** (b) Evaluate: $\int_0^1 x\,(1-x)^n\, dx$; (where $n \in N$).	3
30.	Minimize and maximize Z = 5x + 10y Subject to $x + 2y \le 120$, $x + y \ge 60$, $x - 2y \ge 0$, $x, y \ge 0$. Solve the above LPP graphically.	3
31.	(a) In a hostel, 60% of the students read Hindi newspaper, 40% read English newspaper and 20% read both Hindi and English newspaper. A student is selected at random. (i) Find the probability that the student reads neither Hindi nor English newspaper. (ii) If she reads Hindi newspaper, then find the probability that she reads English newspaper. (iii) If she reads English newspaper, then find the probability that she reads Hindi newspaper. **OR** (b) A person has undertaken a construction job. The probabilities are 0.65 that there will be strike, 0.80 that the construction job will be completed on time if there is no strike, and 0.32 that the construction job will be completed on time if there is a strike. Determine the probability that the construction job will be completed on time.	3

SECTION D

Section D consists of 4 questions of 5 marks each

32. Find the area of the region bounded by the curve $y = |x - 2|$, $x = 1$, $x = 3$ and x-axis. **5**

33. If $A = \begin{bmatrix} 1 & 2 & -3 \\ 2 & 0 & -3 \\ 1 & 2 & 0 \end{bmatrix}$, find A^{-1} and hence solve the following system of linear equations: **5**

$x + 2y - 3z = 1$, $2x - 3z = 2$, $x + 2y = 3$.

34. (a) (i) If the following function $f(x)$ is continuous at $x = 1$, then find the values of a and b. **5**

$$f(x) = \begin{cases} 3ax + b, & if\ x > 1 \\ 11, & if\ x = 1 \\ 5ax - 2b, & if\ x < 1 \end{cases}$$ [3 marks]

(ii) If $y = \sqrt{ax + b}$, prove that $y\left(\frac{d^2y}{dx^2}\right) + \left(\frac{dy}{dx}\right)^2 = 0$ [2 marks]

OR

(b) (i) If $x^y - y^x = a^b$, find $\frac{dy}{dx}$ [3 marks]

(ii) If $y = \cos(\sqrt{3x})$, find $\frac{dy}{dx}$ [2 marks]

35. (a) Find the shortest distance between the lines **5**

$$\vec{r} = (6\hat{i} + 2\hat{j} + 2\hat{k}) + \lambda(\hat{i} - 2\hat{j} + 2\hat{k})$$
$$\vec{r} = (-4\hat{i} - \hat{k}) + \mu(3\hat{i} - 2\hat{j} - 2\hat{k})$$

OR

(b) Find the image of the point (1, 2, 1) with respect to the line $\frac{x-3}{1} = \frac{y+1}{2} = \frac{z-1}{3}$.

Also find the equation of the line joining the given point and its image.

SECTION E

Case study-based questions are compulsory

(This section comprises of 3 case-study/passage-based questions 4 marks each with two sub-parts. Three case study questions have three sub-parts (i), (ii), (iii) of marks 1, 1, 2 respectively).

36. Read the following passage and answer the questions. **4**

The temperature of some days during rainy season is given by

$f(x) = -0.1x^2 + mx + 34.5$, $0 \le x \le 15$, m be a constant, where f(x) is the temperature in ^0C at x-days.