सन्मार्ग मेधा

मॉक प्रश्न पत्र

उच्च माध्यमिक

विषय : गणित
कक्षा : १२

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 MCQs and 2 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 of 4 marks each with sub-parts

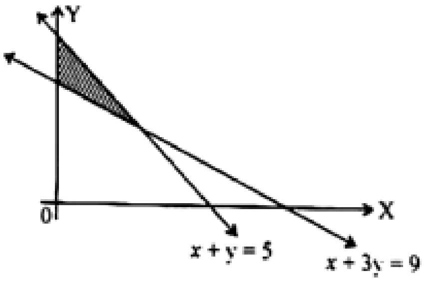
SECTION – A

(All questions are compulsory. No internal choice is provided in this section)

1. If A $=[a_{ij}] = \begin{bmatrix} 2 & -1 \\ -3 & 4 \\ 1 & 2 \end{bmatrix}$ $and\ B = [b_{ij}] = \begin{bmatrix} 2 & 3 & -5 \\ 1 & 4 & 9 \\ 0 & 7 & -2 \end{bmatrix}$, then value of $a_{11}b_{11} + a_{22}b_{22}\ is$ **1**

a) 8
b) 20
c) 10
d) 24

2. In the given figure, what is the LPP shaded region known as? **1**



a) Feasible region
b) Feasible solution
c) Optimal region
d) Objective region

3. **1**

$$\int \frac{2^{x+1} - 5^{x-1}}{10^x} dx =$$

a) $\frac{1}{5}\frac{(2^{-x})}{\log 2} - \frac{2(5^{-x})}{\log 5} + C$
b) $\frac{1}{6}\log(2^{-x}) - 2\ log5(5^{-x}) + C$
c) $\frac{1}{5}log\ (2^{-x}) + 3\log 5(5^{-x}) + C$
d) $None\ of\ these$

4. The area of a triangle with vertices $(-3,0)$, $(3,0)$ and $(0, k)$ is 9 sq. units. The value of k will be. **1**

a) 9 b) 3 c) -9 d) 6

5. The projection of the vector $\hat{\imath} - \hat{\jmath}\ on\ the\ vector\ \hat{\imath} + \hat{\jmath}$ is. **1**

a) 1 b) 0 c) 2 d) 5

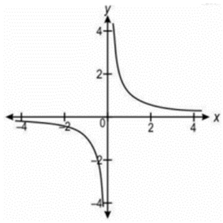
6. Find the integral value of x if **1**

$$[x \quad 4 \quad -1]\begin{bmatrix} 2 & 1 & -1 \\ 1 & 0 & 0 \\ 2 & 2 & 4 \end{bmatrix}[x \quad 4 \quad -1]^T = 0$$

	a) 4 b) -4 c) $\frac{1}{2}, -4$ d) $\frac{1}{2}, 4$	
7.	The area of a parallelogram whose adjacent sides are represented by the vectors $2\hat{\imath} - 3\hat{k}$ and $4\hat{\jmath} + 2\hat{k}$ is (in sq. units) a) $\sqrt{14}$ b) $3\sqrt{14}$ c) $4\sqrt{14}$ d) $2\sqrt{15}$	1
8.	The number of points of discontinuity of f defined by $f(x) = \|x\| - \|x+1\|$ is a) 1 b) 2 c) 0 d) 5	1
9.	Let A be a skew-symmetric matrix of order 3. If $\|A\| = x$, then $(2023)^x =$ a) 2023 b) 1/2023 c) $(2023)^2$ d) 1	1
10.	Find the value of $\frac{dy}{dx}$ at $\theta = \frac{\pi}{3}$ if $x = a\sec^3\theta$ and $y = a\tan^3\theta$ is a) $\sqrt{3}/2$ b) $-\sqrt{3}/2$ c) ½ d) 1	1
11.	The order of differential equation whose general solution is given by $y = (A+B)\cos(x+C) + De^x$ a) 4 b) 5 c) 3 d) 2	1
12.	If A and B are two independent events with P(A)=3/5 and P(B)=4/9, then $P(A' \cap B')=$ a) 4/15 b) 8/45 c) 1/3 d) 2/9	1
13.	If a line makes angles α, β and γ with the axes respectively, then $\cos 2\alpha + \cos 2\beta + \cos 2\gamma =$ a) -2 b) -1 c) 1 d) 2	1
14.	The corner points of the feasible region determined by the set of constraints are P(0,5), Q(3,5), R(5,0) and S(4,1) and the objective function is Z = ax + 2by where a, b > 0. The condition on a and b such that the maximum Z occurs at Q and S is a) $a - 5b = 0$ b) $a - 3b = 0$ c) $a - 2b = 0$ d) $a - 8b = 0$	1
15.	If $\vec{a}.\vec{b} = \frac{1}{2}\|\vec{a}\|\|\vec{b}\|$, then the angle between $\vec{a}$ and $\vec{b}$ is a) 0° b) 30° c) 60° d) 90°	1
16.	If $\begin{vmatrix} 2 & 2 \\ 2 & 3 \end{vmatrix} = \begin{vmatrix} 3x & 1 \\ 4x & 2 \end{vmatrix}$, then $x =$ a) 1 b) 2 c) 1/2 d) 2/3	1
17.	The general solution of the differential equation $\frac{dy}{dx} = 1 - x + y - xy$ is a) $\log\|1+y\| = x - \frac{x^2}{2} + C$ b) $\log\|1+y\| = x - \frac{x}{2} + C$ c) $\log\|1+y\| = x^2 - \frac{x}{2} + C$ d) $\log\|1+y\| = \frac{x^3}{3} - x + C$	1
18.	The position vector of the point which divides the join of points with position vectors $\vec{a} + \vec{b}$ and $2\vec{a} - \vec{b}$ in the ratio 1:2 is. a) $\frac{3\vec{a}+2\vec{b}}{3}$ b) $\vec{a}$ c) $\frac{5\vec{a}-\vec{b}}{3}$ d) $\frac{4\vec{a}+\vec{b}}{3}$	1

For **question 19 and 20,** two statements are given – one labelled Assertion (A) and the other labelled Reason (R). Select the correct answer to these questions from the codes (a), (b), (c) and (d) as given below:

a) Both A and R are true, and R is the correct explanation of the assertion.
b) Both A and R are true, but R is not the correct explanation of the assertion.
c) A is true, but R is false.

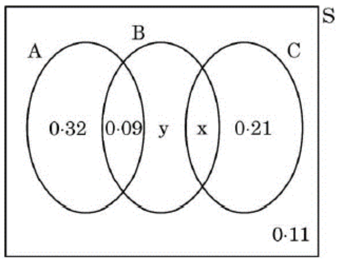
	d) A is false, but R is true	
19.	Shown below is the graph of a function $f: R - \{0\} \to R$ defined by f(x) $= \frac{9-x^2}{9x-x^3}$  Assertion (A): the function f is not onto Reason(R): $3 \in R$ (Co- domain of f) has no pre-image in the domain of f	1
20.	Assertion(A): The function f(x)= $\lvert x-6 \rvert (\cos x)$ is differentiable in $R - \{6\}$ Reason(R): If a function is continuous at a point c, then it is also differentiable at that point.	1
	SECTION-B	
21.	$Evaluate: Sin^{-1}\left(Sin\frac{3\pi}{4}\right) + Cos^{-1}(Cos\,\pi) + tan^{-1}\frac{1}{\sqrt{3}}$ ***OR*** *Draw the graph of* $\cos^{-1}x$, *where* $x \in [-1,0]$. Also write its range.	2
22.	Evaluate: $$\int_0^{\infty} \frac{dx}{(x^2+4)(x^2+9)}$$	2
23.	Find the smallest value of polynomial $x^3 - 18x^2 + 96x$ in [0,9]	2
24.	The radius of a spherical soap bubble is increasing at the rate of $0.2cm/sec$. Find the rate of increase of its surface area when the radius is 7 cm. **OR** The amount of pollution content added in air in a city due to x-diesel vehicles is given by P(x)=$0.005x^3 + 0.02x^2 + 30x$.Find the marginal increase in pollution content when 3 diesel vehicles are added.	2
25.	Prove that the function $f(x) = \tan x - 4x$ is strictly decreasing on $\left(-\frac{\pi}{3}, \frac{\pi}{3}\right)$	2
	SECTION C	
26.	If $y = \log[x + \sqrt{x^2+a^2}]$, $show\ that (x^2+a^2)\frac{d^2y}{dx^2} + x\frac{dy}{dx} = 0$	3
27.	Evaluate: $$\int \frac{e^x}{\sqrt{5-4e^x-e^{2x}}}dx$$ **OR** $$\int \sin(\log x)\ dx$$	3
28.	Solve graphically the following linear programming problem: $Maximise\ z = 6x + 3y,$ $subject\ to\ the\ constraints$ $4x + y \geq 80,$ $3x + 2y \leq 150,$ $x + 5y \geq 115,$ $x \geq 0, y \geq 0.$ **OR**	3

	Solve graphically the following linear programming problem: $$Minimise\ z = x + 2y,$$ $$subject\ to\ the\ constraints$$ $$x + 2y \geq 100,$$ $$2x - y \leq 0,$$ $$2x + y \leq 200,$$ $$x \geq 0, y \geq 0.$$	
29.	Three numbers are selected at random (without replacement) from first six positive integers. If X denotes the smallest of the three numbers obtained, find the probability distribution of X. Also, find the mean of the distribution.	**3**
30.	Solve the differential equation: $$(1 + x^2)dy + 2xydx = cotx\ dx, (x \neq 0)$$ **OR** Solve the differential equation: $$xe^{\frac{y}{x}} - y + x\frac{dy}{dx} = 0$$	**3**
31.	Evaluate: $$\int_0^{\pi} \sqrt{1 + 4\sin^2\frac{x}{2} - 4\sin\frac{x}{2}}\,dx$$	**3**
	SECTION D	
32.	Show that relation S in set A=$\{x \in Z: 0 \leq x \leq 12\}$ $given\ by\ S = \{(a, b): a, b \in A, \|a - b\|\ is\ divisible\ by\ 4\}$ is an equivalence relation. Find the set of all elements related to 1 **OR** Consider $f: R^+ \to (-9, \infty) given\ by\ f(x) = 5x^2 + 6x - 9, prove\ that\ f\ is\ bijective (where\ R^+$ is the set of all positive real numbers)	**5**
33.	Solve the following system of equations by matrix method when $x \neq 0, y \neq 0\ and\ z \neq 0$. $$\frac{2}{x} - \frac{3}{y} + \frac{3}{z} = 10$$ $$\frac{1}{x} + \frac{1}{y} + \frac{1}{z} = 10$$ $$\frac{3}{x} - \frac{1}{y} + \frac{2}{z} = 13$$	**5**
34.	Make a rough sketch of the region. $$\{(x, y): 0 \leq y \leq x^2, 0 \leq y \leq x, 0 \leq x \leq 2\}$$ And find the area of the region using integration.	**5**
35.	By computing shortest distance, determine whether the following pair of lines intersect or not $$\vec{r} = (4\hat{\imath} + 5\hat{\jmath}) + \lambda(\hat{\imath} + 2\hat{\jmath} - 3\hat{k})$$ $$\vec{r} = (\hat{\imath} - \hat{\jmath} + 2\hat{k}) + \mu(2\hat{\imath} + 4\hat{\jmath} - 5\hat{k})$$ **OR** Find a vector of magnitude 5 units, perpendicular to each of the vectors $(\vec{a} + \vec{b}) and\ (\vec{a} - \vec{b})$, where $\vec{a} = \hat{\imath} + \hat{\jmath} + \hat{k}$ and $\vec{b} = \hat{\imath} + 2\hat{\jmath} + 3\hat{k}$	**5**

SECTION E

36. There are different types of Yoga which involve the usage of different poses of Yoga Asanas, Meditation and Pranayam

The Venn diagram below represents the probabilities of three different types of Yoga, A, B and C performed by the people of a society. Further, it is given that probability of a member performing type C Yoga is 0·44.



On the basis of the above information, answer the following questions:

i) Find the value of x. **1**

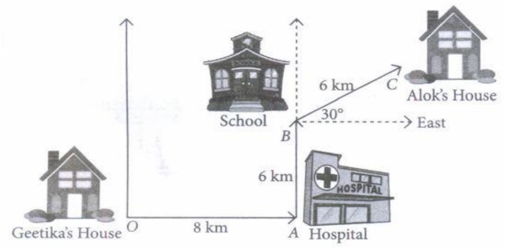
ii) Find the value of y. **1**

iii) Find $P(C|B)$ **2**

OR

Find the probability that a randomly selected person of the society does Yoga of type A or B but not C

37. Geetika house is situated at Kanke at point O, for going to Alok's house she first travels 8 km by bus in the East. Here at point A a hospital is situated, from Hospital, Geetika take an auto and goes 6 km in the North, here at point B school is situated. From school she travels by bus to reach Alok's house which is 30° East,6km from point B



Based on the above information, answer the following questions

i) What is the vector distance between Geetika's house and school? **1**

ii) How much distance Geetika travels to reach school? **1**

iii) What is the total distance travelled by Geetika from her house to Alok's house? **2**

OR

What is the vector distance from school to Alok's house?

38. The shape of a toy is given as $f(x) = 6(2x^4 - x^2)$. To make the toy beautiful 2 sticks which are perpendicular to each other were placed at a point (2, 3), above the toy.

	(i) Find the abscissa of critical point?	2
	(ii) Find the second order derivative of the function at x= 5	2

अपर्णा मणि

अध्यापक, श्री शिक्षायतन स्कूल