THE VILLAGE
INTERNATIONAL SCHOOL
"We Nurture Dreams"

SAMPLE PAPER FOR FIRST TERM EXAMINATION 2023-24

CLASS 12 **MARKS:80**

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.

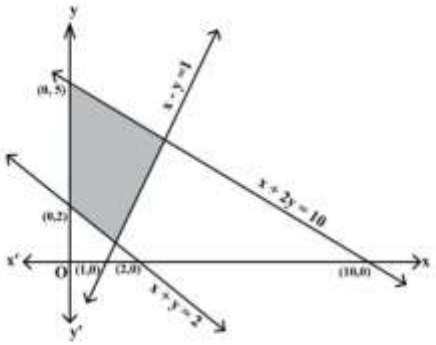
3. Section B has 5 Very Short Answer (VSA)-type questions of 2 marks each.

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 of 4 marks each with sub-parts

	SECTION A	
1	. If $A=[a_{ij}]$ is a square matrix of order 2 such that $a_{ij}=\begin{cases}1, \text{ when } i\neq j\\0, \text{ when } i=j\end{cases}$, then A^2 is (a) $\begin{bmatrix}1&0\\1&0\end{bmatrix}_{2\times2}$ (b) $\begin{bmatrix}1&1\\0&0\end{bmatrix}_{2\times2}$ (c) $\begin{bmatrix}1&1\\1&0\end{bmatrix}_{2\times2}$ (d) $\begin{bmatrix}1&0\\0&1\end{bmatrix}_{2\times2}$	
2	. If A and B are invertible square matrices of the same order, then which of the following is not correct? (a) $\left\|AB^{-1}\right\|=\frac{\|A\|}{\|B\|}$ (b) $\left\|(AB)^{-1}\right\|=\frac{1}{\|A\|\ \|B\|}$ (c) $(AB)^{-1}=B^{-1}A^{-1}$ (d) $(A+B)^{-1}=B^{-1}+A^{-1}$	
3	. If the area of the triangle with vertices $(-3,0),(3,0)$ and $(0,k)$ is **9 sq units,** then the value/s of k will be (a) 9 (b) ±3 (c) -9 (d) 6	

4	If $f(x)=\begin{cases}\frac{kx}{\lvert x\rvert}, & \text{if } x<0\\ 3, & \text{if } x\geq 0\end{cases}$ is continuous at $x=0$, then the value of k is (a) -3 (b) 0 (c) 3 (d) any real number	
5	. The corner points of the bounded feasible region determined by a system of linear constraints are $(0,3),(1,1)$ and $(3,0)$. Let $Z = px + qy$, where $p, q>0$. The condition on p and q so that the minimum of Z occurs at $(3,0)$ and $(1,1)$ is (a) $p=2q$ (b) $p=\frac{q}{2}$ (c) $p=3q$ (d) $p=q$	
6	. The value of $\lvert A\rvert$, if $A=\begin{bmatrix}0 & 2x-1 & \sqrt{x}\\ 1-2x & 0 & 2\sqrt{x}\\ -\sqrt{x} & -2\sqrt{x} & 0\end{bmatrix}$, where $x\in\mathbb{R}^+$, is (a) $(2x+1)^2$ (b) 0 (c) $(2x+1)^3$ (d) $(2x-1)^2$	
7	The feasible region corresponding to the linear constraints of a Linear Programming Problem is given below.  Which of the following is not a constraint to the given Linear Programming Problem? (a) $x+y\geq 2$ (b) $x+2y\leq 10$ (c) $x-y\geq 1$ (d) $x-y\leq 1$	
8.	. Given that A is a square matrix of order 3 and $\lvert A\rvert=-2$, then $\lvert adj(2A)\rvert$ is equal to (a) -2^6 (b) $+4$ (c) -2^8 (d) 2^8	
9.	A problem in Mathematics is given to three students whose chances of solving it are $\frac{1}{2},\frac{1}{3},\frac{1}{4}$ respectively. If the events of their solving the problem are independent then the probability that the problem will be solved, is (a) $\frac{1}{4}$ (b) $\frac{1}{3}$ (c) $\frac{1}{2}$ (d) $\frac{3}{4}$	
10.	The set of all points where the function $f(x)=x+\lvert x\rvert$ is differentiable, is (a) $(0,\infty)$ (b) $(-\infty,0)$ (c) $(-\infty,0)\cup(0,\infty)$ (d) $(-\infty,\infty)$	
11.	If y =5cosx-3sinx, then (a) $\frac{d^2y}{dx^2}$ + y = 0 (b) $\frac{d^2y}{dx^2}$ - y = 0 (c) $\frac{dy}{dx}$ + y = 0 (d) $\frac{dy}{dx}$ - y = 0	
12	The points where the function f(x) = $[x]$, $0\leq x<3$ is not differentiable (a) {0,1,2} (b) {1,2,3} (c) {1,2,3,4.....} (d) None	

13	A family has two children . What is the probability that both the children are boys given that the elder one is a boy? (a) ¼ (b) 1/3 (c) ½ (d) 1	
14	f(x) = $\|x-1\|$ is continuous but not differentiable at x = -------- (a) 0 (b) 1 (c) -1 (d) none	
15	Find the principle value of $\cos^{-1}\left(-\frac{1}{2}\right)$ (a) $\frac{\pi}{2}$ (b) $\frac{\pi}{3}$ (c)	
16	If $y=\sin^{-1}x+\sin^{-1}\sqrt{1-x^2}$; $0<x<1$, then $\frac{dy}{dx}$ is (a) 0 (b) $\frac{1}{2}$ (c) 1 (d) -1.	
17	If Sin($\sin^{-1}\left(\frac{1}{5}\right)+\cos^{-1}x$) = 1, then x = -----	
18	If P(A)=0.4, P(B)=p, P(A∪ B)=0.6 . Find p if A and B are independent events. (a) 2/3 (b) 1 (c) 1/3 (d) none	
	ASSERTION-REASON BASED QUESTIONS **In the following questions, a statement of Assertion (A) is followed by a statement of Reason (R). Choose the correct answer out of the following choices.** **(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.**	
19.	Let $f(x)$ be a polynomial function of degree 6 such that $\frac{d}{dx}(f(x))=(x-1)^3(x-3)^2$, then **ASSERTION (A):** $f(x)$ has a minimum at $x=1$. **REASON (R):** When $\frac{d}{dx}(f(x))<0, \forall x\in(a-h,a)$ and $\frac{d}{dx}(f(x))>0, \forall x\in(a,a+h)$; where '$h$' is an infinitesimally small positive quantity, then $f(x)$ has a minimum at $x=a$, provided $f(x)$ is continuous at $x=a$.	
20.	**ASSERTION (A):** The relation $f:\{1,2,3,4\}\to\{x,y,z,p\}$ defined by $f=\{(1,x),(2,y),(3,z)\}$ is a bijective function. **REASON (R):** The function $f:\{1,2,3\}\to\{x,y,z,p\}$ such that $f=\{(1,x),(2,y),(3,z)\}$ is one-one.	
	SECTION B	
21	Find the value of $\sin^{-1}\left(\cos\left(\frac{33\pi}{5}\right)\right)$.	
22.	Find the domain of $\sin^{-1}(x^2-4)$.	
23.	Find the interval/s in which the function $f:\mathbb{R}\to\mathbb{R}$ defined by $f(x)=xe^x$, is increasing.	
24.	If $f(x)=\frac{1}{4x^2+2x+1}$; $x\in\mathbb{R}$, then find the maximum value of $f(x)$.	
25.	Check whether the function $f:\mathbb{R}\to\mathbb{R}$ defined by $f(x)=x^3+x$, has any critical point/s or not ? If yes, then find the point/s.	

	SECTION C	
26.	Solve the following Linear Programming Problem graphically: Minimize: $z = x + 2y$, subject to the constraints: $x + 2y \geq 100,\ 2x - y \leq 0, 2x + y \leq 200, x, y \geq 0.$ **OR** Solve the following Linear Programming Problem graphically: Maximize: $z = -x + 2y$, subject to the constraints: $x \geq 3, x + y \geq 5, x + 2y \geq 6, y \geq 0.$	
27.	Find the maximum profit that a company can make, if the profit function is given by $P(x) = 72 + 42x - x^2$, where x is the number of units and P is the profit in rupees.	
28.	x = a(cost+tsint) , y = a(sint – tcost) . Find $\frac{d^2y}{dx^2}$.	
29	y = $(sinx)^x$+sin(x^x) . Find $\frac{dy}{dx}$.	
30	y = $\sin^{-1}(\frac{2^{x+1}}{1+4^x})$. Find $\frac{dy}{dx}$.	
31	Show that the relation R in the set A = { x ∈ Z : 0 ≤ x ≤ 12} given by R = {(a,b):$\|a - b\|$is a multiple of 4}is an equivalence relation.	
	SECTION D	
32.	Let $\mathbb{N}$ be the set of all natural numbers and R be a relation on $\mathbb{N} \times \mathbb{N}$ defined by $(a,b)\,R\,(c,d) \Leftrightarrow ad = bc$ for all $(a,b),(c,d) \in \mathbb{N} \times \mathbb{N}$. Show that R is an equivalence relation on $\mathbb{N} \times \mathbb{N}$. Also, find the equivalence class of $(2,6)$, i.e., $[(2,6)]$.	
33.	Show that the function $f : \mathbb{R} \to \{x \in \mathbb{R} : -1 < x < 1\}$ defined by $f(x) = \frac{x}{1+\|x\|}$, $x \in \mathbb{R}$ is one-one and onto function.	
34	Using the matrix method, solve the following system of linear equations : $\frac{2}{x} + \frac{3}{y} + \frac{10}{z} = 4,\ \frac{4}{x} - \frac{6}{y} + \frac{5}{z} = 1,\ \frac{6}{x} + \frac{9}{y} - \frac{20}{z} = 2.$	
35.	Prove that the volume of the largest cone that can be inscribed in a sphere of radius R is $\frac{8}{27}$ of the volume of the sphere.	
	SECTION E **[This section comprises of 3 case- study/passage based questions of 4 marks each with sub parts.** **The first two case study questions have three sub parts (i), (ii), (iii) of marks 1,1,2 respectively.** **The third case study question has two sub parts of 2 marks each.)**	

36 Read the following passage and answer the questions given below:

In an Office three employees Jayant, Sonia and Oliver process incoming copies of a certain form. Jayant processes **50%** of the forms, Sonia processes **20%** and Oliver the remaining **30%** of the forms. Jayant has an error rate of **0.06** , Sonia has an error rate of **0.04** and Oliver has an error rate of **0.03** .

Based on the above information, answer the following questions.

(i) Find the probability that Sonia processed the form and committed an error.

(ii) Find the total probability of committing an error in processing the form.

(iii) The manager of the Company wants to do a quality check. During inspection, he selects a form at random from the days output of processed form. If the form selected at random has an error, find the probability that the form is **not** processed by Jayant.

OR

(iii) Let E be the event of committing an error in processing the form and let E_1, E_2 and E_3 events that Jayant, Sonia and Oliver processed the form. Find the value of $\sum_{i=1}^{3} P(E_i|E)$.

37 . Read the following passage and answer the questions given below:

The relation between the height of the plant $('y' \text{ in cm})$ with respect to its exposure to the sunlight is governed by the following equation $y = 4x - \frac{1}{2}x^2$, where 'x' is the number of days exposed to the sunlight, for $x \leq 3$.

(i) Find the rate of growth of the plant with respect to the number of days exposed to the sunlight.

(ii) Does the rate of growth of the plant increase or decrease in the first three days?
What will be the height of the plant after 2 days?

38.

Two farmers Ramkishan and Gurcharan Singh cultivate only three varieties of rice namely Basmati, Permal and Naura. The sale (in Rupees) of these varieties of rice by both the farmers in the month of September and October are given by the following matrices A and B.

September Sales (in Rupees)

	Basmati	Permal	Naura	
A =	10,000	20,000	30,000	Ramkishan
	50,000	30,000	10,000	Gurcharan Singh

October Sales (in Rupees)

	Basmati	Permal	Naura	
B =	5000	10,000	6000	Ramkishan
	20,000	10,000	10,000	Gurcharan Singh

i. Find the combined sales in September and October for farmer Gurcharan Singh for each variety.

a. 80000 b. 90000 c. 130000 d. 135000

ii. Find the combined sales in September and October for farmer Ramkishan in each variety.

a. 90000 b. 80000 c. 86000 d. 81000

iii. Which variety of Rice has the lowest selling value in the month of September for the farmer Ramkisan?

a. Basmati b. Peermal c. Naura d. All of these have the same price

iv. If both farmers receive 2% profit on gross sales, compute the profit for each farmer and for each variety sold in October.

a.

Basmati	Permal	Naura	
100	200	220	Ram
400	300	200	Gur

b.

Basmati	Permal	Naura	
100	200	120	Ram
400	200	200	Gur

c.

Basmati	Permal	Naura	
150	200	220	Ram
400	200	280	Gur

d.

Basmati	Permal	Naura	
100	200	120	Ram
250	200	220	Gur