ERODE SOHODAYA SCHOOLS COMPLEX

PRE-BOARD EXAMINATION 2023-24

CLASS XII **MATHEMATICS** **TIME: 3 hrs**

SET - B **Max 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 1mark each.
3. **Section B** has 5 **Very Short Answer (VSA)-type** questions of 2marks each.
4. **Section C** has 6 **Short Answer (SA)-type** questions of 3marks each.
5. **Section D** has 4 **Long Answer (LA)-type** questions of 5marks each.
6. **Section E** has 3 **source based/case based/passage based/integrated units of assessment** (4marks each) with sub-parts.

SECTION A

(Multiple Choice Questions)

Each question carries 1mark

1). Order and degree of differential equation $\frac{d^2y}{dx^2} = \left[y + \left(\frac{dy}{dx}\right)^2\right]^{\frac{1}{4}}$

(a) 4 and 2 (b) 1 and 2 (c) 1 and 4 (d) 2 and 4

2). The point which does not lie in the half plane $2x+3y-12 \leq 0$ is

a. (-1,2) b. (2,1) c. (2,3) d.(-3,2)

3). If $\begin{vmatrix} x+1 & x-1 \\ x-3 & x+2 \end{vmatrix} = \begin{vmatrix} 4 & -1 \\ 1 & 3 \end{vmatrix}$, then write the value of x

a. -2 b. 1/2 c. 2 d. 3

4). Integrating factor of differential equation $x\frac{dy}{dx} + 2y = x^2$

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

5). The corner points of the feasible region for a LPP are p(0,5), Q(1,5),R(4,2) and S(12,0). The minimum value of objective function Z= 2x+5y is at the point

a. P b. Q c. R d. S

6). The probability of obtaining an even prime number on each die, when a pair of dice is rolled is

(a) 0 (b) $\frac{1}{3}$ (c) $\frac{1}{12}$ (d) $\frac{1}{36}$

7). If $A = \begin{bmatrix} \sin\alpha & \cos\alpha \\ -\cos\alpha & \sin\alpha \end{bmatrix}$ then the value of the product AA^T is

A) null matrix B) I C) A^2 D) A

8). Let $A = \begin{bmatrix} 0 & 0 & -1 \\ 0 & -1 & 0 \\ -1 & 0 & 0 \end{bmatrix}$, then the only correct statement about the matrix A is

A) A^{-1} does not exist. B) $A^2 = I$

C) A is a zero matrix D) A = (-1) I, where I is identity matrix

9). If A and B are invertible matrices of order 3, $|A| = 2$ and $|(AB)^{-1}| = 6$. Find $|B|$

A) 3 B) $\frac{1}{3}$ C) 12 D) $\frac{1}{12}$

10). If $\begin{bmatrix} 2 & 0 \\ 5 & 4 \end{bmatrix} = P + Q$, where P is a symmetric and Q is a skew symmetric matrix, then Q is equal to

(a) $\begin{bmatrix} 0 & \frac{-5}{2} \\ \frac{5}{2} & 0 \end{bmatrix}$ (b) $\begin{bmatrix} 0 & \frac{5}{2} \\ \frac{-5}{2} & 0 \end{bmatrix}$ (c) $\begin{bmatrix} 2 & \frac{-5}{2} \\ \frac{5}{2} & 4 \end{bmatrix}$ (d) $\begin{bmatrix} 2 & \frac{5}{2} \\ \frac{5}{2} & 4 \end{bmatrix}$

11). The function f(x) = [x], where [x] denotes the greatest integer function, is continuous at

a. 4 b. -2 c. 1 d. 1.5

12). If $y = e^{-x}$, then $\frac{d^2y}{dx^2}$ is equal to

(a) y (b) - y (c) x (d) – x.

13). In ΔABC, $\overrightarrow{AB} = \hat{\imath} + \hat{\jmath} + 2\hat{k}$ and $\overrightarrow{AC} = 3\hat{\imath} - \hat{\jmath} + 4\hat{k}$. If D is the midpoint of BC, then $\overrightarrow{AD}$ is equal to

(a) $4\hat{\imath} + 6\hat{k}$ **(b)** $2\hat{\imath} - 2\hat{\jmath} + 2\hat{k}$ **(c)** $\hat{\imath} - \hat{\jmath} + \hat{k}$ **(d)** $2\hat{\imath} + 3\hat{k}$

14). Unit vector along $\overrightarrow{PQ}$, where coordinates of P and Q respectively are $(2, 1, -1)$ and $(4, 4, -7)$ is

(a) $2\hat{\imath} + 3\hat{\jmath} - 6\hat{k}$ **(b)** $-2\hat{\imath} - 3\hat{\jmath} + 6\hat{k}$

(c) $\frac{-2}{7}\hat{\imath} - \frac{3}{7}\hat{\jmath} + \frac{6}{7}\hat{k}$ **(d)** $\frac{2}{7}\hat{\imath} + \frac{3}{7}\hat{\jmath} - \frac{6}{7}\hat{k}$

15). If Θ is the angle between any two vectors $\vec{a}$ and $\vec{b}$, then $|\vec{a}-\vec{b}|=|\vec{a}+\vec{b}|$, where Θ is

a. 0 b. $\pi/4$ c. $\pi/2$ d. π

16). If a line makes an angle α,β,γ with x, y z axis, then $\sin^2\alpha + \sin^2\beta + \sin^2\gamma =$

A) 1 B) 2 C) 0 D) 3

17). Direction cosines of the line joining the points (3, 7, -2) & (1,4,4) are given by

A) (2,3,-6) B) (-2,-3,6) C) $\left(\frac{2}{7},\frac{3}{7},\frac{-6}{7}\right)$ D) $\left(\frac{1}{7},\frac{2}{7},\frac{3}{7}\right)$

18). $\int_{-\pi/2}^{\pi/2} \sin^5 x\,dx$ equal to

a. 0 b. -1 c. 1 d. 5

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). **Assertion**: A relation R = {(a,b) : |a-b|<2} defined on the set A = {1, 2, 3, 4, 5} is reflexive.

Reason : A relation R on the set A is said to be reflexive if (a,b)$\epsilon\, R$ and $(b,c)\epsilon R$ for all $a,b \,\epsilon\, A$.

20). **Assertion (A):** Let $f(x)$ be a polynomial function of degree 6 such that $\frac{d}{dx}(f(x)) = (x-2)^3(x-3)^2$, then $f(x)$ has a minimum at $x = 2$.

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 $x = a$.

SECTION B

This section comprises of very short answer type-questions (VSA) of 2marks each

21). The volume of a spherical balloon is increasing at the rate of 20 cm^3/sec. Find the rate of change of its surface area at the instant when its radius is 8 cm.

OR

	Find the point of local maxima or local minima and the corresponding local maximum and minimum values of a function: $f(x) = -x^3 + 12x^2 - 5$.
22).	Find the principal value of $\cos^{-1}\left(\frac{1}{2}\right)+2\sin^{-1}\left(\frac{1}{2}\right)+\tan^{-1}\sqrt{3}$ **OR** Evaluate $\tan^{-1}\left[2\sin\left(2\cos^{-1}\frac{\sqrt{3}}{2}\right)\right]$
23).	Find the maximum and minimum value, $f(x) = \lvert x+2\rvert - 1$
24).	Evaluate $\int_0^{\pi} \frac{1}{1+e^{\cos x}}\,dx$
25).	Show that $f(x) = x^9 + 4x^7 + 11$ is an increasing function for all $x \in R$
	<u>SECTION C</u> **This section comprises of Short Answer type questions (SA) of 3marks each**
26).	Solve the differential equation $x\frac{dy}{dx}+2y=x^2, \quad x\neq 0$ **OR** Solve the differential equation $xdy - ydx=(x^2 + y^2)^{1/2}dx$
27).	Evaluate $\int_{-5}^{5}\frac{x^2}{1+e^x}dx$ **OR** Evaluate $\int_0^4\left(\lvert x-1\rvert+\lvert x-2\rvert\right)dx$
28).	Evaluate $\int\frac{2x}{(x^2+1)(x^2+2)}dx$
29).	If $y\sqrt{1+x^2}=\log\left[\sqrt{1+x^2}-x\right]$, then show that $(1+x^2)\frac{dy}{dx}+xy+1=0$

30)	Solve the following LPP graphically: Minimise $z=3x+4y$, subject to $x+2y\leq8$, $3x+2y\leq12$, $x,y\geq0$
31).	Assume that each born child is equally likely to be a boy or girl. If a family has two children, what is the conditional probability that both are girls given that 1. youngest is a girl 2.atleast one is a girl **OR** Probability of solving specific problem independently by A and B are 1/2 and 1/3 respectively. If both try to solve the problem independently, Find the probability that a. The problem is solved b. exactly one of them solves the problem
	SECTION D **This section comprises of Long Answer-type questions (LA) of 5 marks each**
32).	If $A=\begin{pmatrix} 2 & -3 & 5 \\ 3 & 2 & -4 \\ 1 & 1 & -2 \end{pmatrix}$, find A^{-1}. Using A^{-1} solve the system of equation $2x-3y+5z = 11$, $3x+2y-4z = -5$, $x+y-2z = -3$
33).	By computing the shortest distance determine whether the lines intersect or not. If not then find the shortest distance between the lines. $\frac{x-1}{2}=\frac{y-2}{3}=\frac{z-3}{4}$ *and* $\frac{x-2}{3}=\frac{y-4}{4}=\frac{z-5}{5}$ **OR** Find the vector equation of the line passing through the point $(1, 2, -4)$ and perpendicular to the two lines: $\frac{x-8}{3}=\frac{y+19}{-16}=\frac{z-10}{7}$ *and* $\frac{x-15}{3}=\frac{y-29}{8}=\frac{z-5}{-5}$
34).	Find the area bounded by the circle $x^2+y^2=4$ and the line $y=x$ in the first quadrant
35).	Show that the relation R defined by $(a,b)R(c,d) \Rightarrow a+d=b+c$ in the set NXN is an equivalence relation

OR

Let A ={ x ϵ Z : 0 ≤ x ≤12 }. Show that R={(a,b):a,b ϵ A, |a-b| is divisible by 4} is an equivalence relation. Find the set of all elements related to 1

SECTION E

This section comprises of 3 case-study/passage-based questions of 4 marks each. First two questions have three sub-parts (1),(2),(3) of marks 1,1,2 respectively. The third case study question has two sub-parts of 2 marks each.

36). One day a helicopter of enemy is flying along the curve represented by $y=x^2+7$. A soldier placed at (3,7) wants to shoot down the helicopter when it is nearest to him

Based on the above information answer the following

i.If (x_1,y_1) represent the position of helicopter on the curve $y=x^2+7$, then find the relation between x_1 and y_1

ii. Find distance in terms of x_1

iii. Find the minimum distance between the solider and the helicopter

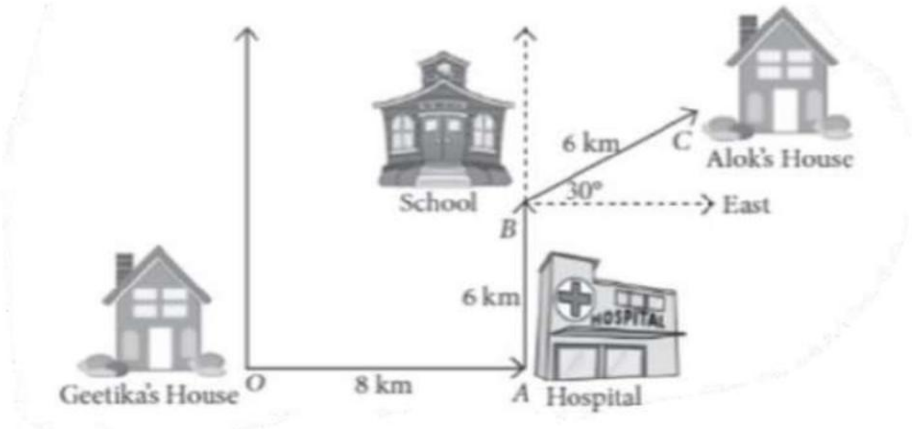
37). In an office three employees Vinay, Sonia and Iqbal process incoming copies of a certain form. Vinay process 50% of the form, Sonia process 20% and Iqbal the remaining 30% of the forms. Vinay has an error rate of 0.06, Sonia has an error rate of 0.04 and Iqbal has an error rate of0.03

Based on the above information, answer the following questions

i. What is the total probability of committing an error in processing the form?

ii. 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 forms. If the form selected at random has an error, find the probability that the form is processed by Vinay

38).



Gitika house is situated at Shalimar Bag at O, going to Aloke's house she first travel 8 km in the east, here at point A a hospital is situated. From the hospital she takes auto and goes 6 km in the north. Here at point B a school is situated. From school she travels by bus to reach Aloke's house which is 30^0 of east and 6 km from point B.

(i) What is vector distance from Gitika's house to school? 1

(ii) What is vector distance from school to Aloke's house? 1

(iii) What is vector distance from Gitika's house to Aloke's house? 2

OR

What is the total distance travel by Gitika from her house to Aloke's house? 2