MAYOOR PRIVATE SCHOOL, ABU DHABI
Academic Year 2024-2025
Pre Board 1 Examination

CLASS: 12
DATE : 06/01/2025
MAX. MARKS : 80

NAME:
SUBJECT : Mathematics
TIME : 3 Hours

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.

SECTION A

(Multiple Choice Questions) Each question carries 1 mark

1.	If A and B are two non-zero square matrices of same order such that $(A + B)^2 = A^2 + B^2$, then : (A) AB = O (B) AB = – BA (C) BA = O (D) AB = BA	1
2.	If X, Y and XY are matrices of order 2 ×3, m ×n and 2 × 5 respectively, then number of elements in matrix Y is : (A) 6 (B) 10 (C) 15 (D) 35	1
3.	The interval in which the function f defined by $f(x) = x^2 - 2x$ is strictly increasing, is (A) $[1, \infty)$ (B) $(1, \infty)$ (C) $(0, \infty)$ (D) $(-\infty, 1)$	1
4.	If A and B are two square matrices of order 2 and $\lvert A\rvert = 2$ and $\lvert B\rvert = 5$, then $\lvert -3AB \rvert$ is : (A) – 90 (B) – 30 (C) 30 (D) 90	1

5.	The sum of the order and the degree of the differential equation $\frac{d^2y}{dx^2}+\left(\frac{dy}{dx}\right)^3 = \sin y$ is : (A) 5 (B) 2 (C) 3 (D) 4	
6.	If $\lvert A\rvert = 2$, where A is a 2 x 2 matrix, then $\lvert 4A^{-1}\rvert$ equals : (A) 4 (B) 2 (C) 8 (D) 32	1
7.	Let A be a skew-symmetric matrix of order 3. If $\lvert A\rvert = x$, then $(2023)^x$ is equal to : (A) 2023 (B) 1/2023 (C) $(2023)^2$ (D) 1	1
8.	If P(A/B) = 0·3, P(A) = 0·4 and P(B) = 0·8, then P(B/A) is equal to : (A) 0·6 (B) 0·3 (C) 0·06 (D) 0·4	1
9.	The projection of the vector $\vec{a} = 2\hat{i} - \hat{j} + \hat{k}$ and $\vec{b} = \hat{i} + 2\hat{j} + 2\hat{k}$ (A) $\frac{2}{3}$ (B) $\frac{1}{3}$ (C) 2 (D) $\sqrt{2}$	1
10.	If $\vec{a}$ and $\vec{b}$ are the unit vectors, then the angle between $\vec{a}$ and $\vec{b}$ for $\sqrt{3}\vec{a} - \vec{b}$ to be a unit vector is (A) 30^0 (B) 45^0 (C) 60^0 (D) 90^0	1
11.	Corner points of the feasible region determined by the system of linear constraints are (0, 3), (1, 1) and (3, 0) . Let Z = p x + q y, where p, q > 0. Condition on p and q so that the minimum of Z occurs at (3, 0) and (1, 1) is (A) p = 2 q (B) 2p =q (C) p = 3 q (D) p = q	1
12.	The value of $\int_1^{\sqrt{3}} \frac{dx}{1+x^2}$ is (A) $\frac{\pi}{3}$ (B) $\frac{2\pi}{3}$ (C) $\frac{\pi}{6}$ (D) $\frac{\pi}{12}$	1

13.	The value of $\int_{-1}^{1} x\,\lvert x\rvert$ is (A) $\frac{1}{6}$ (B) $\frac{1}{3}$ (C) $-\frac{1}{6}$ (D) 0	1
14.	The solution of the differential equation $\frac{dx}{x}+\frac{dy}{y}=0$ is : (A) $\frac{1}{x}+\frac{1}{y}=C$ (B) log x - log y = C (C) xy = C (D) x + y = C	1
15.	The domain of $\sin^{-1}(2x)$ is (A) [0, 1] (B) [– 1, 1] (C) [-1/2, 1/2] (D) [–2, 2]	1
16.	Objective function of LPP problem is (A) a constant (B) a function to be optimized (C) an inequality (D) a quadratic equation	1
17.	The derivative of $\sin(x^2)$ w.r.t. x, at $x=\sqrt{\pi}$ is : (A) 1 (B) – 1 (C) $-2\sqrt{\pi}$ (D) $2\sqrt{\pi}$	1
18.	Area of the region bounded by the curve $y^2 = 4x$, y-axis and the line y = 3 is (A) 2 (B) $\frac{9}{4}$ (C) $\frac{9}{3}$ (D) $\frac{9}{2}$	1
	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)** :The relation R on the set A = { 1, 2, 3, 4, 5, 6 } defined as R = { (x, y) : y is divisible by x } is not an equivalence relation **Reason (R)** : The relation R will be an equivalence relation, if it is reflexive, symmetric and Transitive.	1
20.	**Assertion (A):** f(x) = [x], where [x] is the greatest integer less than or equal to x is continuous at x = 3. **Reason (R):** f(x) = [x], where [x] is the greatest integer less than or equal to x is not differentiable at x = 3.	1

SECTION B

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

21. Evaluate: $\sin^{-1}\left(\sin\frac{3\pi}{4}\right) + \cos^{-1}(\cos\pi) + \tan^{-1}(1)$

22. A particle moves along the curve $6y = x^3 + 2$. Find the points on the curve at which the y-coordinate is changing 8 times as fast as the x-coordinate.

23. (a) Find dy/dx if $x = a(\theta + \sin\theta)$, $y = a(1 - \cos\theta)$.

    OR

    (b) Find dy/dx : if $y/x = x/y$

24. (a) Find the angle between two lines:

    $\vec{r} = 2\hat{i} - 5\hat{j} + \hat{k} + \lambda(3\hat{i} + 2\hat{j} + 6\hat{k})$

    $\vec{r} = 7\hat{i} - 6\hat{k} + \mu(\hat{i} + 2\hat{j} + 2\hat{k})$

    OR

    (b) If the vectors $\vec{a}$ and $\vec{b}$ are such that $|\vec{a}| = 3$, $|\vec{b}| = \frac{2}{3}$ and $\vec{a} \times \vec{b}$ is a unit vector, then find the angle between $\vec{a}$ and $\vec{b}$.

25. If $\vec{a}$, $\vec{b}$ and $\vec{c}$ are unit vectors such that $\vec{a} + \vec{b} + \vec{c} = \vec{0}$, then find the value of $\vec{a}.\vec{b} + \vec{b}.\vec{c} + \vec{c}.\vec{a}$

SECTION C

(This section comprises of short answer type questions (SA) of 3 marks each)

26. Find the particular solution of the following differential equation: (3)

    $\frac{dy}{dx} + 2y\tan x = \sin x$, given that $y = 0$ when $x = \frac{\pi}{3}$

27. Find the intervals in which the following functions are strictly increasing or decreasing: (3)

    $f(x) = -2x^3 - 9x^2 - 12x + 1$

28. (a) Using vectors, find the area of the triangle with vertices A(1, 1, 2), B(2, 3, 5) and C(1, 5, 5). (3)

    OR

    (b) Find the values of p so that the lines are at right angles:

    $\frac{1-x}{3} = \frac{7y-14}{2p} = \frac{z-3}{2}$ and $\frac{7-7x}{3p} = \frac{y-5}{1} = \frac{6-z}{5}$

29.	(a) Evaluate $\int \frac{\cos x}{(1-\sin x)(2-\sin x)}dx$ **OR** (b) Evaluate $\int_0^{\pi} \frac{x}{1+\sin x}dx$	3
30.	Minimise Z = 3x + 5y such that $x + 3y \geq 3$, $x + y \geq 2$, $x, y \geq 0$.	3
31.	(a) E and F are two independent events such that $P(\overline{E}) = 0{\cdot}6$ and $P(E \cup F) = 0{\cdot}6$. Find P(F) and $P(\overline{E} \cup \overline{F})$. **OR** (b) Two numbers are selected at random (without replacement) from the first six positive integers. Let X denote the larger of the two numbers obtained. Find E(X).	3

SECTION D

(This section comprises of long answer-type questions (LA) of 5 marks each)

32.	If A1 denotes the area of the region bounded by $y^2 = 4x$, $x = 1$ and x-axis in the first quadrant and A2 denotes the area of the region bounded by $y^2 = 4x$, $x = 4$, find A1 : A2.	5
33.	Using matrices, solve the system of equations: $2x - 3y + 5z = 11$, $3x + 2y - 4z = -5$, $x + y - 2z = -3$.	5
34.	(a) If $x = a(\cos t + t \sin t)$ and $y = a(\sin t - t\cos t)$, find $\frac{d^2y}{dx^2}$ **OR** (b) If $x^{30}y^{20} = (x+y)^{50}$, prove that $\frac{dy}{dx} = \frac{y}{x}$	5
35.	(a) Find the shortest distance between the lines: $\vec{r} = \hat{i} + 2\hat{j} + \hat{k} + \lambda(\hat{i} - \hat{j} + \hat{k})$. $\vec{r} = 2\hat{i} - \hat{j} - \hat{k} + \mu(2\hat{i} + \hat{j} + 2\hat{k})$. **OR** (b) 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 $\frac{x-15}{3} = \frac{y-29}{8} = \frac{z-5}{-5}$	5

SECTION E

Section E has 3 source based/case based/passage based/integrated units of assessment (4 marks each) with sub parts.

36. Engine displacement is the measure of the cylinder volume swept by all the pistons of a piston engine. The piston moves inside the cylinder bore

The cylinder bore in the form of a circular cylinder open at the top is to be made from a metal sheet of area 75 cm^2.

Based on the above information, answer the following questions :

(i) If the radius of the cylinder is r cm and height is h cm, then write the volume V of the cylinder in terms of radius r. **1**

(ii) Find dV/ dr . **1**

(iii) (a) Find the radius of the cylinder when its volume is maximum. **2**

OR

(b) For maximum volume, h > r. State true or false and justify.

37. Students of a school are taken to a railway museum to learn about railways heritage and its history.

An exhibit in the museum depicted many rail lines on the track near the railway station. Let L be the set of all rail lines on the railway track and *R* be the relation on L defined by R = { (l_1, l_2): l_1 is parallel to l_2 }

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

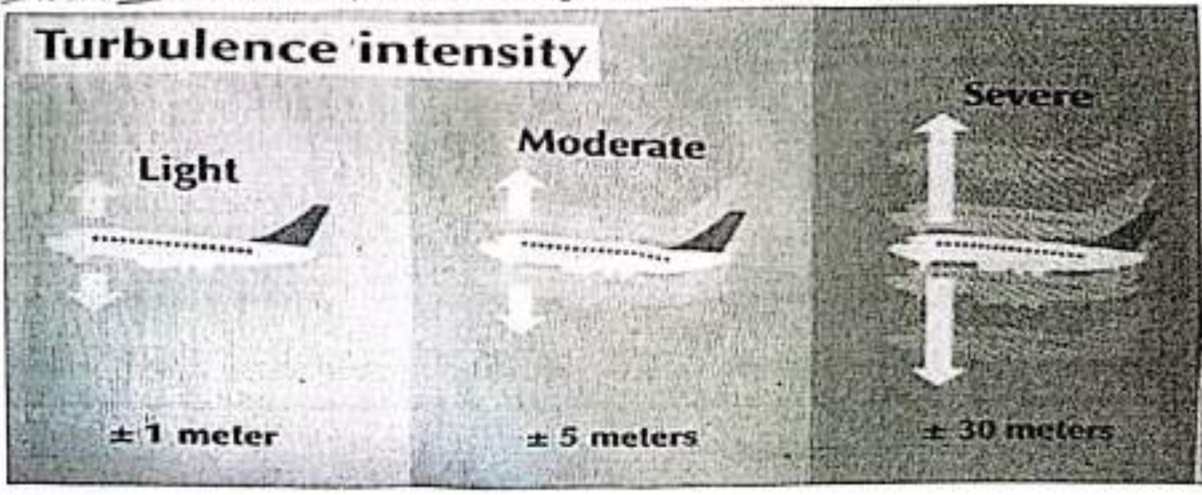
(i) Find whether the relation R is symmetric or not. **1**

(ii) Find whether the relation R is transitive or not **1**

(iii) (a) If one of the rail lines on the railway track is represented by the equation $y = 3x+2$, then find the set of rail lines in R related to it. **2**

OR

(b) Let S be the relation defined by S = { (l_1, l_2): l_1 is perpendicular to l_2 } check whether the relation S is symmetric and transitive.

38.	According to recent research, air turbulence has increased in various regions around the world due to climate change. Turbulence makes flights bumpy and often delays the flights. Assume that, an airplane observes severe turbulence, moderate turbulence or light turbulence with equal probabilities. Further, the chance of an airplane reaching late to the destination are 55%, 37% and 17% due to severe, moderate and light turbulence respectively.  On the basis of the above information, answer the following questions : (i) Find the probability that an airplane reached its destination late. (ii) If the airplane reached its destination late, find the probability that it was due to moderate turbulence	 2 2