Please check total printed pages before start : 8

Roll No. : ☐☐☐

PRE-BOARD II (2022-23)

SUBJECT : MATHEMATICS

CLASS : XII

Time : 3 hours 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 MCQs 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)

Q1. If A is matrix of order $m \times n$ and B is a matrix such that AB' and B'A are both defined, then order of matrix B is

(a) $m \times m$ (b) $n \times n$ (c) $n \times m$ (d) $m \times n$

Q2. If A is any square matrix of order 3×3 such that $|A| = 3$, Then the value of $|\text{adj} A|$ is:

(a) 3 (b) $\frac{1}{3}$ (c) 9 (d) 27

Q3. If $|\vec{a}|=10, |\vec{b}|=2$ and $\vec{a}.\vec{b}=12$, then the value of $|\vec{a}\times\vec{b}|$ is

(a) 5 (b) 10 (c) 12 (d) 16

Q4. The relationship between p and q so that the function f defined by

$$f(x)=\begin{cases} px+1, if\ x\le 2, \\ qx+3, if\ x>2 \end{cases}$$ is continuous at x=2, is

(a) p − q = 2 (b) p + q = 1 (c) p − q = 1 (d) p + q = 2

Q5. $\int \frac{e^{\tan^{-1}x}}{1+x^2}dx$ is equal to –

(a) $(1+x^2)\ e^{\tan^{-1}x}+C$ (b) $\tan^{-1}x+C$ (c) $e^{\tan^{-1}x}+C$ (d) None of these.

Q6. The integrating factor of differential equation $\cos x\frac{dy}{dx}+y\sin x=1$, is:

(a) cos x (b) tan x (c) sec x (d) sin x

Q7. The point which does not lie in the half plane (feasible region) $2x+3y-12\le 0$ is

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

Q8. If θ is the angle between any two vectors $\vec{a}\ and\ \vec{b}$, then

$\left|\vec{a}.\vec{b}\right|=\left|\vec{a}\times\vec{b}\right|$ when θ is equal to –

(a) 0 (b) $\frac{\pi}{4}$ (c) $\frac{\pi}{2}$ (d) π

Q9. $\int_{-\frac{\pi}{4}}^{\frac{\pi}{4}}\frac{dx}{1+\cos 2x}$ is equal to –

(a) 1 (b) 2 (c) 3 (d) 4

Q10. The number of all possible matrices of order 3 × 3 with each entry -1 or 1 is:

(a) 27 (b) 18 (c) 81 (d) 512

Q11. The corner points of the feasible region determined by the system of linear constraints are (0, 40), (20, 40), (60, 20), (60, 0). For objective function Z=3y+4x , correct option is:

(a) Max. Z = 260 (b) Min. Z = 160 (c) Max. Z = 300

(d) All incorrect

Q12. If A is a square matrix such that $|A| = 5$, Then the value of $|AA'|$ is –

(a) 25 (b) 26 (c) 27 (d) 28

Q13. If A is a 3 × 3 matrix, $|A| \neq 0$ and $|3A| = k|A|$, then the value of k is–

(a) 25 (b) 26 (c) 27 (d) 28

Q14. If P(A) = $\frac{1}{2}$, , P(B) = 0.3. Where events A and B are mutually exclusive, then $P(A|B)$ is -

(a) 0 (b) $\frac{1}{2}$ (c) not defined (d) 1

Q15. The general solution of $e^x \cos y dx - e^x \sin y dy = 0$ is

(a) $e^x \cos y = k$ (b) $e^x \sin y = k$ (c) $e^x = k \cos y$

(d) $e^x = k \sin y$

Q16. If- $x = t^2$ and $y = t^3$ then $\frac{d^2y}{dx^2}$ is –

(a) $\frac{3}{2}$ (b) $\frac{3}{4t}$ (c) $\frac{3}{2t}$ (d) $\frac{3}{4}$

Q17. The magnitude of projection $\left(2\hat{i} - \hat{j} + \hat{k}\right) on \left(\hat{i} - 2\hat{j} + 2\hat{k}\right)$ is –

(a) 1 unit (b) 2 units (c) 3 units (d) 4 units

Q18. If a line makes angles α, β, γ with the positive direction of co – ordinate axes, then the value of $\sin^2\alpha + \sin^2\beta + \sin^2\gamma$ is –

(a) 0 (b) 1 (c) 2 (d) 3

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.

Q19. **Assertion (A)**: Range of $\cot^{-1} x$ is $(0, \pi)$

c **Reason (R)**: Domain of $\tan^{-1} x$ is $\mathbf{R_+}$.

Q20. **Assertion (A)**: The acute angle between the line $\vec{r} = \hat{i} + \hat{j} + 2\hat{k} + \lambda(\hat{i} - \hat{j})$ and the x-axis is $\pi/4$.

Reason (R): The acute angle θ between the lines

b) $\vec{r} = x_1\hat{i} + y_1\hat{j} + z_1\hat{k} + (a_1\hat{i} + b_1\hat{j} + c_1\hat{k})$ and

$\vec{r} = x_2\hat{i} + y_2\hat{j} + z_2\hat{k} + \mu(a_2\hat{i} + b_2\hat{j} + c_2\hat{k})$ is given by:

$$\cos\theta = \frac{|a_1a_2 + b_1b_2 + c_1c_2|}{\sqrt{a_1^2 + b_1^2 + c_1^2}\sqrt{a_2^2 + b_2^2 + c_2^2}}$$

SECTION-B

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

Q21. Write the principal value of $\tan^{-1}\left(\sqrt{3}\right) + \cot^{-1}\left(-\sqrt{3}\right)$.

OR

If A = {1, 2, 3}, B = {4, 5, 6, 7} and f ={(1,4), (2,5), (3,6)} is a function from A to B. State whether f is one – one and onto or not.

Q22. The radius of a cylinder is increasing at the rate of 5 cm/min so that its volume is constant. Find the rate of decreasing of its height when its radius is 5 cm and height is 3 cm.

Q23. Find a vector in the direction of $\vec{a} = \hat{i} - 2\hat{j}$ that has magnitude 7 units.

OR

If a line makes angles 90^0, 60^0 and θ with x, y and z axis respectively, Where θ is acute, then find θ.

Q24. Write the derivative of sin x with respect to cos x.

Q25. Write a unit vector in the direction of vector $\overrightarrow{PQ}$ where $\vec{P}\, and\, \vec{Q}$ are the points (1, 3,0) and (4,5,6) respectively.

SECTION-C

(THIS SECTION COMPRISES OF SHORT ANSWER TYPE QUESTIONS (SA) OF 3 MARKS EACH)

Q26. Find:. $\int \frac{(x-3)}{e^{-x}(x-1)^3} dx$

Q27. A card from a pack of 52 cards is lost. From the remaining cards of the pack, two cards are drawn and are found to be both diamonds. Find the probability of the lost card being a diamond.

OR

Bag I contains 3 red and 4 black balls while another Bag II contains 5 red and 6 black balls. One ball is drawn at random from one of the bags and it is found to be red. Find the probability that it was drawn from Bag II.

Q28. Evaluate: $\int_0^{\frac{\pi}{4}} \log(1+\tan x)dx$

OR

Evaluate: $\int_1^3 |x^2 - 2x| dx$

Q29.Solve the differential equation: $x\frac{dy}{dx} = y - x\tan\left(\frac{y}{x}\right)$

OR

Solve the differential equation: $(x-y)\frac{dy}{dx}=x+2y$

Q30. Solve the following Linear Programming Problem graphically:
Minimize z = 6x+3y subject to
$4x+y\geq 80, x+5y\geq 115, 3x+2y\leq 150, x\geq 0, y\geq 0$

Q31. Find: $\int\frac{x}{(x^2+1)(x-1)}dx$

SECTION-D

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

Q32. Using the method of integration find the area of the region bounded by lines:
2x + y = 4, 3x – 2y = 6 and x – 3y + 5 = 0.

Q33. Let A = $A=\{x\in Z:0\leq x\leq 12\}$. Show that R = $\{(a,b):a,b\in A,|a-b|$ is divisible by 4}. Is R an equivalence relation? Find the set of all elements related to 1. Also write the Equivalence class for [2].

OR

Show that the relation S in the set R of real numbers defined as $S=\{(a,b):a,a,\mathrm{b}\in\mathrm{R}\,\mathrm{and}\,\mathrm{a}\leq \mathrm{b}^3\ \}$ is neither reflexive nor symmetric nor transitive.

Q34. Find the shortest distance between the lines:
$\frac{x-1}{1}=\frac{2-y}{3}=\frac{z-3}{2}\, and\, \frac{x-4}{2}=\frac{y-5}{3}=\frac{12-2z}{-2}$

OR

Find the vector and cartesian equations of the line which is perpendicular to the lines with the equations : $\frac{x+2}{1}=\frac{y-3}{2}=\frac{z+1}{4}\, and\, \frac{x-1}{2}=\frac{y-2}{3}=\frac{z-3}{4}$ and passes through the point (1 1 1)

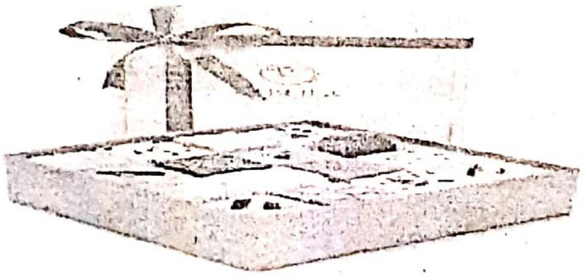
Q35. If A=$\begin{bmatrix} 2 & -3 & 5 \\ 3 & 2 & -4 \\ 1 & 1 & -2 \end{bmatrix}$, find A^{-1}. Use A^{-1} to solve the following system of

Equations: $2x - 3y + 5z = 11$, $3x + 2y - 4z = -5$, $x + y - 2z = -3$

SECTION - E

(This section comprises of 3 case-study/passage-based questions of 4 marks each with two sub-parts. 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.)

Q36.**Case-Study1**: Read the following passage and answer the questions given below.



Sonam wants to prepare a sweet box for Diwali at home. For making lower part of box, she takes a square piece of card board of side 18cm.

(i) If x cm be the length of each side of the square cardboard which is to be cut off from corner of the square piece of side 18 cm, then x must lie in which interval?

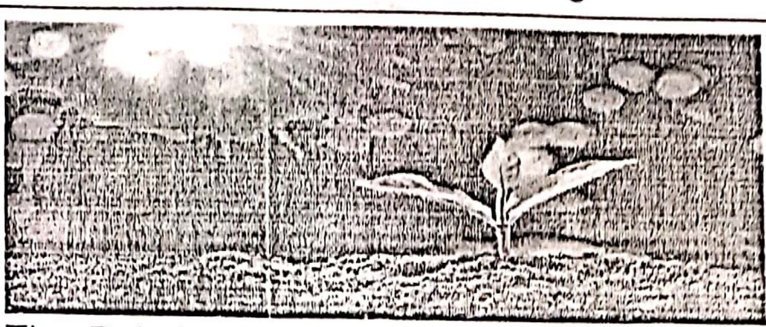
(ii) What is expression for volume?

(iii) Find the values of x for which $\frac{dV}{dx}=0$.

OR

What is the value of maximum volume?

Q37.**Case-Study2**: Read the following passage and answer the questions given below.



The Relation between the height of the plant (y in cm) with respect to exposure to sunlight is governed by the following equation $y = 4x - \frac{1}{2}x^2$, where x is the number of days (max 5) exposed to sunlight.

(i) What is the number of days it will take for the plant to grow to the maximum height?

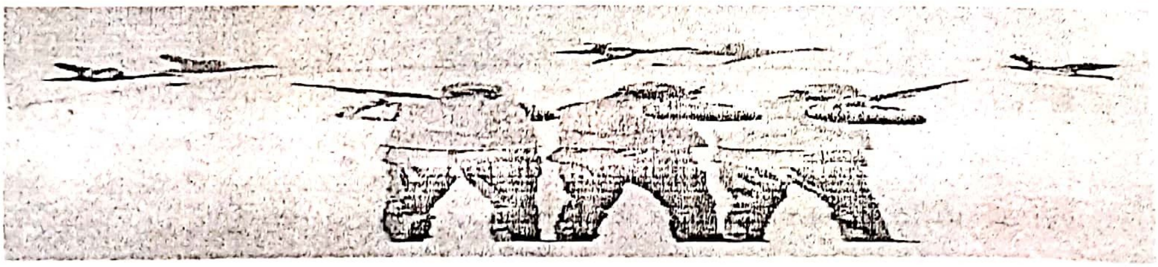
(ii) What is the maximum height of the plant?

(iii) What will be the height of the plant after 2 days?

OR

If the height of the plant is $\frac{7}{2}$ cm, then what is the number of days it has been exposed to the sunlight?

Q38. **Case-Study2**: Read the following passage and answer the questions given below.



A coach is training 3 players. He observes that the player A can hit target 4 times in 5 shots, player B can hit 3 times in 4 shots and the player C can hit 2 times in 3 shots

(i) What is the probability that 'none of them will hit the target?

(ii) What is the probability that exact two of them will hit the target?