Design of Question Paper

Mathematics - Class XII

Time : 3 hours **Max. Marks : 100**

Weightage of marks over different dimensions of the question paper shall be as follows :

A. Weightage to different topics/content units

S.No.	Topics	Marks
1.	Relations and functions	10
2.	Algebra	13
3.	Calculus	44
4.	Vectors & three-dimensional Geometry	17
5.	Linear programming	06
6.	Probability	10
	Total	**100**

B. Weightage to different forms of questions

S.No.	Forms of Questions	Marks for each question	No. of Questions	Total Marks
1.	Very Short Answer questions (VSA)	01	10	10
2.	Short answer questions (SA)	04	12	48
3.	Long answer questions (LA)	06	07	42
	Total		**29**	**100**

C. Scheme of Options

There will be no overall choice. However, an internal choice in any four questions of four marks each and any two questions of six marks each has been provided.

D. Difficulty level of questions

S.No.	Estimated difficulty level	Percentage of marks
1.	Easy	15
2.	Average	70
3.	Difficult	15

Based on the above design, separate sample papers along with their blue prints and Marking schemes have been included in this document. About 20% weightage has been assigned to questions testing higher order thinking skills of learners.

Class XII
MATHEMATICS
Blue-Print I

S.No.	TOPIC	VSA (1)Mark	SA (4) Marks	LA (6) Marks	Total
1. (a)	Relations & Functions	1 (1)	4 (1)	-	5 (2) } 10 (4)
(b)	Inverse Trigonometric functions	1 (1)	4 (1)	-	5 (2)
2. (a)	Matrices	2 (2)	-	6 (1)	8 (3) } 13 (5)
(b)	Determinants	1 (1)	4 (1)	-	5 (2)
3. (a)	Continuity & Differentiability	-	8 (2)	-	8 (2) } 19 (5)
(b)	Applications of Derivatives	1 (1)	4 (1)	6 (1)	11 (3)
(c)	Integrals	1 (1)	12 (3)	-	13 (4) } 19 (5)
(d)	Applications of Integrals	-	-	6 (1)	6 (1)
(e)	Differential Equations	-	-	6 (1)	6 (1) 6 (1)
4. (a)	Vectors	2 (2)	4 (1)	-	6 (3) } 17 (6)
(b)	Three Dimensional Geometry	1 (1)	4 (1)	6 (1)	11 (3)
5.	Linear Programming	-	-	6 (1)	6 (1) } 6 (1)
6.	Probability	-	4 (1)	6 (1)	10 (2) } 10 (2)
	Total	10 (10)	48 (12)	42 (7)	**100 (29)**

Sample Question Paper - I

MATHEMATICS

Class XII

Time : 3 Hours **Max. Marks : 100**

General Instructions

1. All questions are compulsory.

2. The question paper consist of 29 questions divided into three sections A, B and C. Section A comprises of 10 questions of one mark each, section B comprises of 12 questions of four marks each and section C comprises of 07 questions of six marks each.

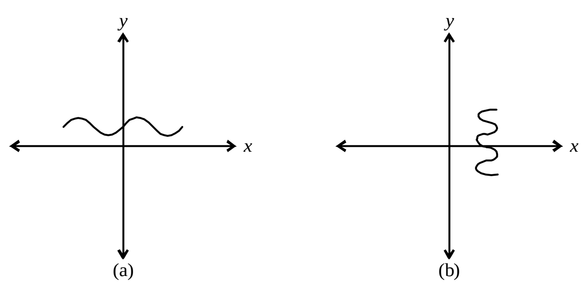
3. All questions in Section A are to be answered in one word, one sentence or as per the exact requirement of the question.

4. There is no overall choice. However, Internal choice has been provided in 04 questions of four marks each and 02 questions of six marks each. You have to attempt only one of the alternatives in all such questions.

5. Use of calculators is not permitted. You may ask for logarithmic tables, if required.

SECTION - A

1. Which one of the following graphs represent the function of x ? Why ?



2. What is the principal value of

$$\cos^{-1}\left(\cos\frac{2\pi}{3}\right)+\sin^{-1}\left(\sin\frac{2\pi}{3}\right) \ ?$$

3. A matrix A of order 3×3 has determinant 5. What is the value of $|3A|$?

4. For what value of x, the following matrix is singular ?

$$\begin{bmatrix} 5-x & x+1 \\ 2 & 4 \end{bmatrix}$$

5. Find the point on the curve $y = x^2 - 2x + 3$, where the tangent is parallel to x-axis.

6. What is the angle between vectors $\vec{a}$ & $\vec{b}$ with magnitude √3 and 2 respectively ? Given $\vec{a} \cdot \vec{b} = 3$.

7. Cartesian equations of a line AB are.

$$\frac{2x-1}{2} = \frac{4-y}{7} = \frac{z+1}{2}$$

Write the direction ratios of a line parallel to AB.

8. Write a value of $\int e^{3\log x}\left(x^4\right)dx$

9. Write the position vector of a point dividing the line segment joining points A and B with position vectors $\vec{a}$ & $\vec{b}$ externally in the ratio

1 : 4, where $\vec{a} = 2\hat{i} + 3\hat{j} + 4\hat{k}$ and $\vec{b} = -\hat{i} + \hat{j} + \hat{k}$

10. If $A = \begin{bmatrix} 2 & 1 & 4 \\ 4 & 1 & 5 \end{bmatrix}$ and $B = \begin{bmatrix} 3 & -1 \\ 2 & 2 \\ 1 & 3 \end{bmatrix}$

Write the order of AB and BA.

SECTION - B

11. Show that the function $f : \mathbf{R} \to \mathbf{R}$ defined by $f(x) = \dfrac{2x-1}{3}$, $x \in \mathbf{R}$ is one-one and onto function. Also find the inverse of the function f.

OR

Examine which of the following is a binary operation

(i) $a * b = \dfrac{a+b}{2}$, $a, b \in N$

(ii) $a * b = \dfrac{a+b}{2}$, $a, b \in Q$

for binary operation check the commutative and associative property.

12. Prove that

$$\tan^{-1}\left(\frac{63}{16}\right) = \sin^{-1}\left(\frac{5}{13}\right) + \cos^{-1}\left(\frac{3}{5}\right)$$

13. Using elementary transformations, find the inverse of

$$\begin{bmatrix} 2 & -6 \\ 1 & -2 \end{bmatrix}$$

OR

Using properties of determinants, prove that

$$\begin{vmatrix} -bc & b^2+bc & c^2+bc \\ a^2+ac & -ac & c^2+ac \\ a^2+ab & b^2+ab & -ab \end{vmatrix} = (ab+bc+ca)^3$$

14. Find all the points of discontinuity of the function **f** defined by

$$f(x) = \begin{matrix} x+2, & x \le 1 \\ x-2, & 1 < x < 2 \\ 0, & x \ge 2 \end{matrix}$$

15. If $x^p y^q = (x+y)^{p+q}$, prove that $\frac{dy}{dx} = \frac{y}{x}$

OR

Find $\frac{dy}{dx}$, if $y = \tan^{-1}\left[\frac{\sqrt{1+x^2}+\sqrt{1-x^2}}{\sqrt{1+x^2}-\sqrt{1-x^2}}\right], 0 < |x| < 1$

16. Evaluate $\int \frac{(x^2+1)(x^2+4)}{(x^2+3)(x^2-5)} dx$

17. A water tank has the shape of an inverted right circular cone with its axis vertical and vertex lower most. Its semi-vertical angle is $\tan^{-1}\left(\frac{1}{2}\right)$. Water is poured into it at a constant rate of 5 cubic meter per minute. Find the rate at which the level of the water is rising at the instant when the depth of water in the tank is 10m.

18. Evaluate the following integral as limit of sum $\int_1^2 (3x^2-1)dx$

19. Evaluate $\int_0^{\pi/2} \log \sin x \, dx$

20. Find the vector equation of the line parallel to the line $\frac{x-1}{5} = \frac{3-y}{2} = \frac{z+1}{4}$ and passing through (3, 0, –4). Also

find the distance between these two lines.

21. In a regular hexagon ABC DEF, if $\vec{AB} = \vec{a}$ and $\vec{BC} = \vec{b}$, then express $\vec{CD}, \vec{DE}, \vec{EF}, \vec{FA}, \vec{AC}, \vec{AD}, \vec{AE}$ and $\vec{CE}$ in terms of $\vec{a}$ and $\vec{b}$.

22. A football match may be either won, drawn or lost by the host country's team. So there are three ways of forecasting the result of any one match, one correct and two incorrect. Find the probability of forecasting at least three correct results for four matches.

OR

A candidate has to reach the examination centre in time. Probability of him going by bus or scooter or by other means of transport are $\frac{3}{10}, \frac{1}{10}, \frac{3}{5}$ respectively. The probability that he will be late is $\frac{1}{4}$ and $\frac{1}{3}$ respectively, if he travels by bus or scooter. But he reaches in time if he uses any other mode of transport. He reached late at the centre. Find the probability that he travelled by bus.

SECTION - C

23. Find the matrix P satisfying the matrix equation

$$\begin{bmatrix} 2 & 1 \\ 3 & 2 \end{bmatrix} P \begin{bmatrix} -3 & 2 \\ 5 & -3 \end{bmatrix} = \begin{bmatrix} 1 & 2 \\ 2 & -1 \end{bmatrix}$$

24. Find all the local maximum values and local minimum values of the function

$$f(x) = \sin 2x - x, \qquad -\frac{\pi}{2} < x < \frac{\pi}{2}$$

OR

A given quantity of metal is to be cast into a solid half circular cylinder (i.e., with rectangular base and semicircular ends). Show that in order that the total surface area may be minimum, the ratio of the length of the cylinder to the diameter of its circular ends is $\pi : (\pi + 2)$.

25. Sketch the graph of

$$f(x) = \begin{cases} |x-2| + 2, & x \le 2 \\ x^2 - 2, & x > 2 \end{cases}$$

Evaluate $\int_0^4 f(x)\, dx$. What does the value of this integral represent on the graph ?

26. Solve the following differential equation $(1 - x^2)\frac{dy}{dx} - xy = x^2$, given $y = 2$ when $x = 0$

27. Find the foot of the perpendicular from P(1, 2, 3) on the line

$$\frac{x-6}{3}=\frac{y-7}{2}=\frac{z-7}{-2}$$

Also obtain the equation of the plane containing the line and the point (1, 2, 3)

28. Let X denote the number of colleges where you will apply after your results and P(X = x) denotes your probability of getting admission in x number of colleges. It is given that

$$P(X=x)=\begin{cases} kx & \text{if } x=0 \text{ or } 1 \\ 2kx & \text{if } x=2 \\ k(5-x) & \text{if } x=3 \text{ or } 4 \end{cases}, \quad \text{k is +ve constant}$$

(a) Find the value of k.

(b) What is the probability that you will get admission in exactly two colleges?

(c) Find the mean and variance of the probability distribution.

OR

Two bags A and B contain 4 white 3 black balls and 2 white and 2 black balls respectively. From bag A two balls are transferred to bag B. Find the probability of drawing

(a) 2 white balls from bag B ?

(b) 2 black balls from bag B ?

(c) 1 white & 1 black ball from bag B ?

29. A catering agency has two kitchens to prepare food at two places A and B. From these places 'Mid-day Meal' is to be supplied to three different schools situated at P, Q, R. The monthly requirements of the schools are respectively 40, 40 and 50 food packets. A packet contains lunch for 1000 students. Preparing capacity of kitchens A and B are 60 and 70 packets per month respectively. The transportation cost per packet from the kitchens to schools is given below :

Transportation cost per packet (in rupees)		
To	**From**	
	A	**B**
P	5	4
Q	4	2
R	3	5

How many packets from each kitchen should be transported to school so that the cost of transportation is minimum ? Also find the minimum cost.