This Question Paper consists of **45** questions and **9** printed pages + Graph Sheet.

Roll No. | | | | | | | | | | | | |

MATHEMATICS Code No. 71/SS/311/A/RE

(311) SET A

Day and Date of Examination .....

Signature of Invigilators 1. .....

2. .....

General Instructions :

1. Candidate must write his/her Roll Number on the first page of the Question Paper.
2. Please check the Question Paper to verify that the total pages and the total number of questions contained in the Question Paper are the same as those printed on the top of the first page. Also check to see that the questions are in sequential order.
3. Making any identification mark in the Answer-Book or writing Roll Number anywhere other than the specified places will lead to disqualification of the candidate.
4. Write your Question Paper Code No. **71/SS/311/A/RE, Set A** on the Answer-Book.
5. (a) The Question Paper is in English/Hindi medium only. However, if you wish, you can answer in any one of the languages listed below :

   English, Hindi, Urdu, Punjabi, Bengali, Tamil, Malayalam, Kannada, Telugu, Marathi, Odia, Gujarati, Konkani, Manipuri, Assamese, Nepali, Kashmiri, Sanskrit and Sindhi.

   You are required to indicate the language you have chosen to answer in the box provided in the Answer-Book.

   (b) If you choose to write the answer in the language other than Hindi and English, the responsibility for any errors/mistakes in understanding the questions will be yours only.
6. In case of any doubt or confusion in the question paper, the **English** Version will prevail.

MATHEMATICS
(311)

Time : **3** Hours] [Maximum Marks : **100**

Note : (i) This question paper consists of **45** questions in all.

(ii) **All** questions are **compulsory**.

(iii) Marks are given against each question.

(iv) **Section – A** consists of :

(a) **Q. No. 1** to **20** – Multiple Choice type Questions (MCQs) carrying **1** mark each. Select and write the most appropriate option out of the four options given in each of these questions.

(b) **Q. No. 21** to **29** – Objective type questions.

Q. No. 21 to **24** carry **2** marks each (with **2** sub-parts of **1** mark each).

Q. No. 25 to **28** carries **4** marks each (with **4** sub-parts of **1** mark each) and

Q. No. 29 carries **6** marks (with **6** sub-parts of **1** mark each).

Attempt these questions as per the instructions given for each of the questions **21** to **29**.

(v) **Section – B** consists of :

(a) **Q. No. 30** to **38** – Very Short Answer type questions carrying **2** marks each.

(b) **Q. No. 39** to **43** – Short Answer type questions carrying **4** marks each.

(c) **Q. No. 44** and **45** – Long Answer type questions carrying **6** marks each.

An internal choice has been provided in some of these questions in Section – B.

You have to attempt only one of the given choices in such questions.

General Instruction :

1. Answers of **all** questions are to be given in the Answer-Book given to you.
2. **15** minutes time has been allotted to read this Question Paper. The question paper will be distributed at **02.15** p.m. From **02.15** p.m. to **02.30** p.m., the students will read the question paper only and will not write any answer on the Answer-Book during this period.

SECTION – A

1. The distance between the points (–1, –1) and (–2, 6) is **1**

(A) 50 units

(B) $\sqrt{5}$ units

(C) $\sqrt{10}$ units

(D) $5\sqrt{2}$ units

2. The slope of the normal to the line joining (5, 6) and (2, 3) is **1**

(A) –1

(B) 1

(C) $\sqrt{3}$

(D) 2

3. The value of $\hat{i} \cdot (\hat{j} \times \hat{k}) - \hat{j} \cdot (\hat{k} \times \hat{i}) - \hat{k} \cdot (\hat{j} \times \hat{i})$ is **1**

(A) 0

(B) 1

(C) –1

(D) 2

4. If $A = [a_{ij}]$ is a symmetric matrix of order $m \times n$, then **1**

(A) $a_{ij} = 0$ for $i = j$

(B) $a_{ij} = a_{ji}$ for all i, j

(C) $a_{ij} = -a_{ji}$ for all $i = j$

(D) $a_{ij} = 0$ for $i \neq j$

5. If $\begin{vmatrix} 3 & x \\ x & 1 \end{vmatrix} = \begin{vmatrix} 3 & 2 \\ 8 & 1 \end{vmatrix}$, then the value of x is **1**

(A) 4

(B) 2

(C) ± 4

(D) ± 2

6. If A is a square matrix of order 3 and $|A| = 3$, then $|A^{-1}| =$ **1**

(A) 3

(B) $\frac{2}{3}$

(C) 12

(D) $\frac{1}{3}$

7. If A is a square matrix such that $A^2 = A$, then $(I + A)^3 - 7A =$ **1**

(A) I

(B) I – A

(C) 3A

(D) A

8. If $A = \begin{bmatrix} 0 & 1 \\ 1 & 0 \end{bmatrix}$, then $A^2 =$ **1**

(A) A

(B) –A

(C) Identity matrix

(D) Zero matrix

1

9. If $f(x) = |x - 4|$, $g(x) = x^2 + 1$, then $fog(1) =$

(A) -2 (B) 2

(C) -3 (D) 3

1

10. $\cos^{-1}(-x) =$

(A) $\cos^{-1} x$ (B) $-\cos^{-1} x$

(C) $\sin^{-1} x$ (D) $\pi - \cos^{-1} x$

1

11. $\lim_{x \to 2} \frac{x^2 - 4}{x - 2} =$

(A) 4 (B) 2

(C) -4 (D) not defined

1

12. If $y = \log \sin x$, then $\frac{dy}{dx} =$

(A) $\sin x$ (B) $\cos x$

(C) $\cot x$ (D) $\tan x$

1

13. If $y = \cos x$, then $\frac{d^2y}{dx^2} =$

(A) $\sin x$ (B) $-\sin x$

(C) $\cos x$ (D) $-\cos x$

1

14. The function $f(x) = \cos x$ is decreasing in the interval

(A) $[0, \pi]$ (B) $(0, \pi)$

(C) $\left(-\frac{\pi}{2}, \frac{\pi}{2}\right)$ (D) $[\pi, 2\pi]$

1

15. $\int \frac{2x + 1}{x} dx =$

(A) $2x + 1 + c$ (B) $2x + \log x + c$

(C) $2 + \log x$ (D) $\log x$

1

16. $\int_{-5}^{5} \sin^5 x \, dx =$

(A) 10 (B) 5

(C) 0 (D) -5

17. The octet where the point (–2, –5, –1) lies is

(A) I (B) III

(C) V (D) VII

1

18. If p : Euclid is the father of geometry.

q : Euclid is not the father of geometry.

Then which of the following is true ?

1

(A) q is the negation of p. (B) q is the converse of p.

(C) p is the contra-positive of q. (D) q is the contra-positive of p.

19. If the slope of a line is $\frac{-3}{5}$, then slope of its normal is

1

(A) $\frac{-3}{5}$ (B) $\frac{-5}{3}$

(C) $\frac{5}{3}$ (D) $\frac{-3}{-5}$

20. Sum of the direction of cosines of z-axis is :

1

(A) 0 (B) 1

(C) –1 (D) 2

21. Write TRUE for a correct statement and FALSE for an incorrect statement : $1 \times 2 = 2$

(i) The relation R = {(1, 2), (2, 2), (3, 2)} is a function.

(ii) The principal value of $\sin^{-1} x$ is $\left[0, \frac{\pi}{2}\right]$.

22. Match Column-I statement with the correct option of Column-II : $1 \times 2 = 2$

	Column-I		Column-II
(i)	The distance between the points (8, 2, –6) and (2, 5, –4) is	(P)	(3, –1, –8)
(ii)	The direction ratios of PQ where P(1, 2, –3) and Q(4, 3, 5) is	(Q)	7
		(R)	(3, 1, 8)
		(S)	5

23. Fill in the blanks : $1 \times 2 = 2$

(i) $\frac{d}{dx}$ [sin (log x)] = $\cos x$.

(ii) $\frac{d}{dx}$ [$\text{cosec}^{-1} x$] = $\frac{1}{x\sqrt{x^2-1}}$.

24. (i) Write the converse of "If a number is multiple of 2, then it is even". **1 × 2 = 2**

(ii) Write the contrapositive of "If x is a rational number, then it can be expressed in $\frac{p}{q}$ form".

25. Fill in the blanks : **1 × 4 = 4**

The equation $9x^2 - 16y^2 = 144$

(i) represents a conic called _____.

(ii) whose eccentricity is _____.

(iii) vertices are _____.

(iv) length of latus rectum is _____.

26. Match Column-I statement with the correct option of Column-II. **1 × 4 = 4**

Column-I	**Column-II**
(i) The order of the matrix $\begin{bmatrix} 3 & 2 & 1 \\ 1 & 0 & -1 \end{bmatrix}$ is	(P) Skew-symmetric matrix
(ii) $\begin{bmatrix} 0 & -1 & 2 \\ 1 & 0 & 3 \\ -2 & -3 & 0 \end{bmatrix}$ is a	(Q) 3×2
(iii) $\begin{bmatrix} 3 & 0 & 0 \\ 0 & 4 & 0 \\ 0 & 0 & 5 \end{bmatrix}$ is a	(R) 7
(iv) If $\begin{bmatrix} 3x & 0 \\ 0 & 5 \end{bmatrix} = \begin{bmatrix} 6 & 0 \\ 0 & y \end{bmatrix}$, then $x + y =$	(S) 2×3
	(T) Diagonal matrix
	(U) 5

27. Fill in the blanks : **1 × 4 = 4**

(i) $\int \sec x \, dx =$ _____.

(ii) $\int \text{cosec } x \cdot \sin x \, dx =$ _____

(iii) $\frac{d}{dx}(\tan^{-1} \sqrt{x}) =$ _____

(iv) $\frac{d}{dx}(x^{-2}) =$ _____.

28. Write TRUE for a correct statement and FALSE for an incorrect statement : **1 × 4 = 4**

(i) The angle between the lines whose direction are a, b, c and b – c, c – a, a – b is 90°.

(ii) If $|\vec{a}| = 3$, $|\vec{b}| = 4$, $\theta = 0°$, then $\vec{a} \cdot \vec{b} = 0$.

(iii) If two vectors $\vec{a}$ and $\vec{b}$ are parallel, then $\vec{a} = \lambda\vec{b}$.

(iv) Direction cosines of x-axis are (–1, 0, 0).

29. Fill in the blanks. **1 × 6 = 6**

(i) The order of the differential equation $3\frac{d^2y}{dx^2} + \frac{d^3y}{dx^3} + y = 0$ is _____.

(ii) $\int e^x \left(\frac{1}{x} - \frac{1}{x^2}\right) dx =$ _____.

(iii) If $y = x^3$, then $\frac{d^2y}{dx^2} =$ _____.

(iv) $\int_{-3}^{3} \sin x + 3x^3 - 4x \, dx =$ _____.

(v) $\frac{d}{dx}(\log(\sec x + \tan x)) =$ _____.

(vi) The maximum value of $f(x) = \cos x, x \in \left[\frac{\pi}{2}, \pi\right] =$ _____.

Section – B

30. Find the equation of parabola whose focus is the point (2, 3) and whose directrix is the line x – 4y + 3 = 0. **2**

OR

Find the equation of circle which touches the x-axis.

31. Find the equation of hyperbola with vertices (± 2, 0) and foci (± 3, 0). **2**

32. Expand the determinant $\begin{vmatrix} 1 & 2 & 3 \\ 3 & 1 & 2 \\ 2 & 3 & 1 \end{vmatrix}$ using second column. **2**

OR

Find A × Adj. A, if $A = \begin{bmatrix} 3 & -2 \\ 4 & -5 \end{bmatrix}$.

33. If $A = \begin{bmatrix} 1 & 0 \\ 2 & -1 \end{bmatrix}$ and $B = \begin{bmatrix} -2 & 1 \\ 0 & -1 \end{bmatrix}$, then find $(AB)^{-1}$. **2**

34. Prove that $\cos^{-1} x = \tan^{-1}\left(\frac{\sqrt{1-x^2}}{x}\right)$. **2**

OR

Prove that $2\tan^{-1} x = \sin^{-1}\left(\frac{2x}{1+x^2}\right)$.

35. Evaluate $\lim_{x \to 2} \frac{\sqrt{3-x}-1}{2-x}$. **2**

OR

Evaluate $\lim_{x \to 2} \frac{\sin 3x}{\tan 4x}$.

36. Verify Lagrange Mean Value theorem for the function $f(x) = x^2$ in $[2, 4]$. **2**

37. Reduce the equation of the plane $2x + 6y - 3z + 5 = 0$ to the normal form. **2**

38. Consider the function $f : \left[0, \frac{\pi}{2}\right] \to R$ given by $f(x) = \sin x$ and $g :: \left[0, \frac{\pi}{2}\right] \to R$ given by $g(x) = \cos x$. Show that f and g are one-one but $f + g$ is not one-one. **2**

39. Find the equation of a line which passes through the point (3, 4) and makes intercepts on the axes equal in magnitude but opposite in sign. **4**

OR

Find the equation of the line with $\alpha = 135°$ and perpendicular distance $P = \sqrt{2}$ from the origin.

40. Solve the following system of equations using matrix method : **4**

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

OR

Find x if $\begin{bmatrix} x & -5 & -1 \end{bmatrix} \begin{bmatrix} 1 & 0 & 2 \\ 0 & 2 & 1 \\ 2 & 0 & 3 \end{bmatrix} \begin{bmatrix} x \\ 4 \\ 1 \end{bmatrix} = 0$.