Roll No. | | | | | | | Answer Sheet No._____

Sig. of Candidate._____ Sig. of Invigilator._____

MATHEMATICS HSSC–I

SECTION – A (Marks 20)

Time allowed: 25 Minutes

NOTE: Section–A is compulsory and comprises pages 1-2. All parts of this section are to be answered on the question paper itself. It should be completed in the first 25 minutes and handed over to the Centre Superintendent. Deleting/overwriting is not allowed. Do not use lead pencil.

Q. 1 Circle the correct option i.e. A / B / C / D. Each part carries one mark.

(i) Which of the following is the simplified form of the complex number i^{-7}?

A. 1 B. $-i$ C. i D. -1

(ii) Let A and B be two non-empty sets such that $A \cap B = \phi$. Which of the following formulas is true?

A. $n(A \cup B) = n(A) + n(B)$ B. $n(A \cap B) = n(A) - n(B)$

C. $n(A \setminus B) = n(A) - n(B)$ D. $n(A \cup B) = 0$

(iii) Which of the following is the contrapositive of the logical statement $p \rightarrow q$?

A. $q \rightarrow p$ B. $\sim q \rightarrow \sim p$ C. $\sim p \rightarrow \sim q$ D. $\sim q \rightarrow p$

(iv) Which of the following structures is true for the set of Natural numbers under the multiplication?

A. a groupoid only B. a semigroup but not a monoid

C. a monoid but not a group D. a group

(v) What is the nature of roots of the quadratic equation $x^2 - x - 1 = 0$?

A. Real and equal B. Real and unequal

C. Rational and unequal D. Complex

(vi) If A is a square matrix, then which of the following arguments is true?

A. $|A| = |-A|$ B. $|A| = |A'|$ C. $|A| = |-A'|$ D. $|A^2| = |A|$

(vii) Which of the following is the solution (x, y) of the system of equations: $\begin{matrix} x - 2y = 2 \\ -x + 2y = 2 \end{matrix}$?

A. $(0, 1)$ B. $(2, 2)$ C. $(2, 0)$ D. Solution does not exist

(viii) Let one root of the equation $ax^2 + bx + c = 0$ is $1 + i$. Then what will be the other root?

A. $1 - i$ B. $-1 - i$ C. $-1 + i$ D. 2

(ix) If $a_n = (n+1)a_{n-1}$, where $a_1 = 1$, then, what will be a_3?

A. 4 B. 12 C. 8 D. 10

(x) The expression $\frac{x}{x^2+1} - \frac{1}{x+1}$ is the resolved partial fraction of:

A. $\frac{x+1}{(x^2+1)(x+1)}$ B. $\frac{x}{(x^2+1)(x+1)}$ C. $\frac{x-1}{(x^2+1)(x+1)}$ D. $\frac{2x}{(x^2+1)(x+1)}$

(xi) Let A.M. and G.M. between the two numbers a and b are equal. Then, which of the following expressions is equal to $(a+b)^2$?

A. $4ab$ B. $4a^2b^2$ C. $2ab$ D. $2\sqrt{ab}$

(xii) If G.M. between k and $\frac{1}{k^2}$ is $\frac{1}{2}$, then what is the value of k?

A. $\sqrt{2}$ B. $\frac{1}{2}$ C. 4 D. 2

DO NOT WRITE ANYTHING HERE

(xiii) If a die is rolled, then what is the probability that the top is greater than 4?

A. $\frac{1}{2}$ B. $\frac{2}{3}$ C. $\frac{1}{3}$ D. $\frac{1}{4}$

(xiv) What is the value of $\operatorname{cosec}^2 100° - \cot^2 100°$?

A. 1 B. -1 C. 0 D. 2

(xv) The middle term of the expansion of $\left(x - \frac{1}{x}\right)^{12}$ is the:

A. 6th term B. 7th term C. 8th term D. 5th term

(xvi) The range of the function $y = \cot x$ is:

A. $-1 \le y \le 1$ B. $y \le -1 \text{ or } y \ge 1$ C. $\mathbb{R}$ D. $\mathbb{R} \setminus \{n\pi : n \in \mathbb{Z}\}$

(xvii) The value of $\operatorname{cosec}^{-1}\left(\frac{-2}{\sqrt{3}}\right)$ is:

A. $-60°$ B. $-30°$ C. $120°$ D. $150°$

(xviii) If one acute angle of a right angle triangle is 35°, then the other acute angle is of measure:

A. $145°$ B. $65°$ C. $45°$ D. $55°$

(xix) If ABC is an equilateral triangle, then with the usual notations:

A. $3r = r_1 + r_2 + r_3$ B. $3r = r_1 r_2 r_3$ C. $r_1 r_2 r = r_3$ D. $r^3 = 3r_1 r_2 r_3$

(xx) The value of $\cos[\pi - \cos^{-1}\left(\frac{1}{2}\right)]$ is:

A. π B. $-\frac{1}{2}$ C. $-\pi$ D. $\frac{1}{2}$

For Examiner's use only:

Total Marks:	**20**
Marks Obtained:	

MATHEMATICS HSSC–I

40

Time allowed: 2:35 Hours **Total Marks Sections B and C: 80**

NOTE: Attempt any ten parts from Section 'B' and any five questions from Section 'C' on the separately provided answer book. Use supplementary answer sheet i.e. Sheet–B if required. Write your answers neatly and legibly. Graph paper will be provided on request.

SECTION – B (Marks 40)

Q. 2 Attempt any TEN parts. All parts carry equal marks. **(10 x 4 = 40)**

(i) Express $1+i\sqrt{3}$ in the polar form.

(ii) If $S=\{1,-1,i,-i\}$. Set up its multiplication table and show that the set S is a group under multiplication.

(iii) Solve the matrix equation $\begin{bmatrix}4 & 3\\ 2 & 2\end{bmatrix}A-\begin{bmatrix}2 & 3\\ -1 & -2\end{bmatrix}=\begin{bmatrix}-1 & -4\\ 3 & 6\end{bmatrix}$ for the matrix A.

(iv) When $x^4+2x^3+kx^2+3$ is divided by $x-2$, the remainder is 1. Find the value of k.

(v) If α,β are the roots of the equation $5x^2-x-2=0$, then form the equation whose roots are $\frac{3}{\alpha}$ and $\frac{3}{\beta}$.

(vi) Resolve $\frac{3x-11}{(x^2+1)(x+3)}$ into partial fractions.

(vii) How many terms of the series $-7+(-4)+(-1)+\cdots$ amounts to 114?

(viii) Find values of n and r when ${}^nC_r=35$ and ${}^nP_r=210$.

(ix) Find the coefficient of x^n in the expansions of $\left(1-x+x^2-x^3+\cdots\right)^2$.

(x) Express the sexagasimal measure 75° 6′ 30″ into radian measurement.

(xi) Prove that $\frac{\cos 8^\circ-\sin 8^\circ}{\cos 8^\circ+\sin 8^\circ}=\tan 37^\circ$.

(xii) Show that $\sin x$ is a periodic function and its period is 2π.

(xiii) Prove that, with usual notations, $R=\frac{abc}{4\Delta}$.

(xiv) Show that $2\tan^{-1}\left(\frac{1}{3}\right)+\tan^{-1}\left(\frac{1}{7}\right)=\frac{\pi}{4}$.

SECTION – C (Marks 40)

Note: Attempt any FIVE questions. All questions carry equal marks. **(5 x 8 = 40)**

Q. 3 Show that the logical statement $\sim q\wedge(p\rightarrow q)\rightarrow\sim p$ is a tautology.

Q. 4 Solve the equation $\begin{vmatrix}x & 0 & 1 & 1\\ 0 & 1 & -1 & -1\\ 1 & -2 & 3 & 4\\ -2 & x & 1 & -1\end{vmatrix}=0$.

Q. 5 Solve the equation $\left(x-\frac{1}{x}\right)^2+3\left(x+\frac{1}{x}\right)=0$.

Q. 6 If $y=\frac{2}{3}x+\frac{4}{9}x^2+\frac{8}{27}x^3+\cdots$ and if $0<x<\frac{3}{2}$, then show that $x=\frac{3y}{2(1+y)}$.

Q. 7 Use the principal of Mathematical Induction to show that $1^2+3^2+5^2+\cdots+(2n-1)^2=\frac{n(4n^2-1)}{3}$ for every positive integer n.

Q. 8 Show that $\frac{\tan\theta+\sec\theta-1}{\tan\theta-\sec\theta+1}=\tan\theta+\sec\theta$.

Q. 9 Prove that $\frac{1}{r}=\frac{1}{r_1}+\frac{1}{r_2}+\frac{1}{r_3}$.

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MATHEMATICS HSSC–I

SECTION – A (Marks 20)

Time allowed: 25 Minutes

NOTE: Section–A is compulsory and comprises pages 1-2. All parts of this section are to be answered on the question paper itself. It should be completed in the first 25 minutes and handed over to the Centre Superintendent. Deleting/overwriting is not allowed. Do not use lead pencil.

Q. 1 Circle the correct option i.e. A / B / C / D. Each part carries one mark.

(i) What is the measure of radius of the circle of which a sector has area of measure $\frac{\pi}{4}$ square units against the arc length of measure 2?

A. $\frac{\pi}{2}$ B. 2 C. $\frac{\pi}{4}$ D. π

(ii) What is the primary period of $\tan(\frac{3x}{2})$?

A. $\frac{2\pi}{3}$ B. $\frac{\pi}{2}$ C. $\frac{3\pi}{2}$ D. π

(iii) What is the modulus value of the complex number $\frac{3-4i}{4+3i}$?

A. 4 B. 5 C. 1 D. 3

(iv) Which of the following numbers is rational?

A. 0 B. $\sqrt{8}$ C. e D. π

(v) Let $x \in A' \cup B'$. Then, which of the following statements is true?

A. $x \in A$ *and* $x \in B$ B. $x \notin A$ *or* $x \notin B$

C. $x \in A$ *or* $x \in B$ D. $x \notin A$ *and* $x \notin B$

(vi) What is the number of elements of the power set $P(X)$ *of* $X = \{0\}$?

A. 1 B. 4 C. 0 D. 2

(vii) Which of the following quadratic equations has the roots 2 and –3?

A. $x^2+x+6=0$ B. $x^2-x-6=0$ C. $x^2+x-6=0$ D. $x^2-x+6=0$

(viii) If A is a skew-symmetric matrix, then A^2 is:

A. Hermitian B. Skew-Hermitian

C. Symmetric D. Skew-Symmetric

(ix) Let A be a matrix of order 3×4. Which of the following equations is true?

A. $I_3A=A$ B. $AA'=I_3$ C. $I_4A=A$ D. $AI_3=A$

(x) When the polynomial $f(x)$ is divided by $x-1$, the quotient is $x+1$ and the remainder is 1. What will be $f(x)$ equal to?

A. x^2+2 B. x^2-1 C. x^2 D. x^2-2

(xi) If ω is a cube root of unity, then ω^{-14} has the simplified form as:

A. ω^2 B. –1 C. 1 D. ω

(xii) The expression $\frac{1}{x-1}-\frac{1}{x+1}$ is the resolved partial fraction of:

A. $\frac{2}{(x^2-1)}$ B. $\frac{1}{2(x^2-1)}$ C. $\frac{x}{2(x^2-1)}$ D. $\frac{2x}{(x^2-1)}$

DO NOT WRITE ANYTHING HERE

(xiii) If $S_n = 2^n - 1$, then what will be the second term a_2 equal to?

A. 1 B. 2 C. 3 D. 4

(xiv) If $\frac{a}{b}, \frac{b}{c}, \frac{c}{a}$ is a G.P., then what will be b equal to?

A. a^2 B. c^2 C. a D. c

(xv) What is the sum of the series $1 + \frac{1}{2} + \frac{1}{4} + \cdots$?

A. $\frac{3}{2}$ B. $\frac{1}{3}$ C. 2 D. $\frac{2}{3}$

(xvi) If ${}^{10}C_4 = {}^{10}C_{r-4}$, then r =

A. 10 B. 8 C. 4 D. 6

(xvii) A coin is tossed thrice. What is the probability that all three will be heads?

A. $\frac{1}{2}$ B. $\frac{1}{8}$ C. $\frac{1}{3}$ D. $\frac{1}{6}$

(xviii) For what value(s) of x, the sum of the series $1 + x + x^2 + x^3 + \cdots$ is valid?

A. $|x| > 1$ B. $x = -1$ C. $x = 1$ D. $|x| < 1$

(xix) What is the value of $\sin(\frac{-13\pi}{6})$?

A. $\frac{-\sqrt{3}}{2}$ B. $\frac{\sqrt{3}}{2}$ C. $-\frac{1}{2}$ D. $\frac{1}{2}$

(xx) What is the range of the function given by $y = \sin^{-1}(x)$?

A. $-1 \le y \le 1$ B. $\mathbb{R}$ (all real numbers)

C. $-\pi \le y \le \pi$ D. $\frac{-\pi}{2} \le y \le \frac{\pi}{2}$

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Total Marks:	**20**
Marks Obtained:	

MATHEMATICS HSSC–I

Time allowed: 2:35 Hours **Total Marks Sections B and C: 80**

NOTE: Attempt any ten parts from Section 'B' and any five questions from Section 'C' on the separately provided answer book. Use supplementary answer sheet i.e. Sheet–B if required. Write your answers neatly and legibly. Graph paper will be provided on request.

SECTION – B (Marks 40)

Q. 2 Attempt any TEN parts. All parts carry equal marks. **(10 x 4 = 40)**

(i) Find the multiplicative inverse of the complex number $(\sqrt{2}, -\sqrt{5})$.

(ii) For set $A = \{1, 2, 3, 4\}$, state the domain and range of the relation $R = \{(x, y) \mid x + y = 5\}$ on the set A.

(iii) If $A = \begin{pmatrix} i & 0 \\ 1 & -i \end{pmatrix}$, then show that $A^4 = I_2$.

(iv) Solve the equation $x^{\frac{2}{5}} + 8 = 6x^{\frac{1}{5}}$.

(v) Discuss the nature of the roots of the equation $9x^2 - 12x + 4 = 0$.

(vi) Resolve $\frac{x^2 + x - 1}{(x+2)^3}$ into partial fractions.

(vii) The A.M. between two numbers is 5 and their G.M. is 4. Find the numbers.

(viii) In how many ways can 5 boys and 4 girls be seated on a bench so that the girls and the boys occupy the alternate seats?

(ix) Evaluate $\sqrt[3]{30}$ correct to three places of decimals.

(x) Find values of $\sin\theta$ and $\cos\theta$ for $\theta = \frac{-17\pi}{3}$.

(xi) Show that $\cos 2\theta = \frac{1 - \tan^2\theta}{1 + \tan^2\theta}$.

(xii) Express $\sin\theta - \cos\theta$ in the form $r\sin(\theta + \phi)$, where the terminal sides of the angles of measures θ and ϕ are in the first quadrant.

(xiii) In a triangle ABC with usual notations, prove that area Δ of the triangle ABC is given by $\Delta = \sqrt{s(s-a)(s-b)(s-c)}$ where $a = |BC|, b = |AC|, c = |AB|$ and $s = \frac{a+b+c}{2}$

(xiv) Find the primary period of $\tan(\frac{x}{3})$.

SECTION – C (Marks 40)

Note: Attempt any FIVE questions. All questions carry equal marks. **(5 x 8 = 40)**

Q. 3 Find out the real and imaginary parts of the complex number $\left(\frac{1-\sqrt{3}i}{1+\sqrt{3}i}\right)^5$

Q. 4 Solve the system of linear equations $\begin{matrix} x + 2y + z = 2 \\ 2x + y + 2z = -1 \\ 2x + 3y - z = 9 \end{matrix}$ by reducing its Augmented matrix to the Echelon form and to the Reduced Echelon form.

Q. 5 Show that the roots of the equation $x^2 + (mx + c)^2 = a^2$ will be equal if $c^2 = a^2(1 + m^2)$.

Q. 6 Find the n^{th} term of the geometric sequence if $\frac{a_5}{a_3} = \frac{4}{9}$ *and* $a_2 = \frac{4}{9}$

Q. 7 Find the term independent of x in the expansion of $\left(\sqrt{x} + \frac{1}{2x^2}\right)^{10}$.

Q. 8 Find the value of $\cos(\alpha + \beta)$ if $\tan\alpha = \frac{-15}{8}$ and $\sin\beta = \frac{-7}{25}$ and neither the terminal side of the angle of measure α nor that of β is in the quadrant IV.

Q. 9 With the usual notations, prove that $\Delta = r^2 \cot\frac{\alpha}{2} \cdot \cot\frac{\beta}{2} \cdot \cot\frac{\gamma}{2}$