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Version No.			
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Answer Sheet No._____

Sign. of Candidate _____

Sign. of Invigilator _____

Section – A is compulsory. All parts of this section are to be answered on this page and handed over to the Centre Superintendent. Deleting/overwriting is not allowed. **Do not use lead pencil.**

MATHEMATICS HSSC–I

SECTION – A (Marks 20)

Time allowed: 25 Minutes

حصہ اوّل لازمی ہے۔ اس کے جوابات اسی صفحہ پر دیے گئے کرنا ظم مرکز کے حوالے کریں۔ کاٹ کر دوبارہ لکھنے کی اجازت نہیں ہے۔ لیڈ پنسل کا استعمال ممنوع ہے۔

Fill the relevant bubble against each question:

ہر سوال کے سامنے دیے گئے درست دائرہ کو پُر کریں۔

1. For a complex number z, all the following formulas are true **EXCEPT**:
   ◯ $\bar{z} = z$ ◯ $z\bar{z} = |z|^2$ ◯ $z^2 = |z|^2$ ◯ $|z| = |\bar{z}|$

2. Which of the following sets forms an abelian group under the operation of multiplication?
   ◯ Set of rational numbers ◯ Set of integers ◯ Set of natural numbers ◯ Set of non-zero real numbers

3. Suppose the number of players that play cricket and hockey are 15 and 13 respectively. If the total number of players is 21, what is the number of players that play both the games?
   ◯ 6 ◯ 8 ◯ 7 ◯ 28

4. If A is a matrix of order 3×4, then which of the following equalities is **TRUE**?
   ◯ $AI_3 = A$ ◯ $I_4A = A$ ◯ $AA' = I_4$ ◯ $AI_4 = A$

5. $\begin{vmatrix} 1 & 0 & 0 \\ 2 & -i & 0 \\ 3 & -2 & i \end{vmatrix} =$
   ◯ 1 ◯ −1 ◯ i ◯ $-i$

6. If $f(x)$ is a polynomial with only two roots 1 and 2, then $f(x) =$
   ◯ x^2+3x-2 ◯ x^2+3x+2 ◯ x^2-3x+2 ◯ x^2-3x-2

7. If one root of the equation $f(x)=0$ is -1, then $5-f(-1) =$
   ◯ 6 ◯ 4 ◯ 5 ◯ −6

8. The partial fraction of $\frac{1}{1-x^3}$ will be in the form of:
   ◯ $\frac{A}{1-x}+\frac{Bx+C}{1-x^2}$ ◯ $\frac{A}{1-x}+\frac{Bx+C}{1+x+x^2}$ ◯ $\frac{A}{1-x}+\frac{Bx+C}{(1-x)^2}$ ◯ $\frac{A}{1-x}+\frac{B}{1-x+x^2}$

9. If $a_1=-1$ in a sequence with general term $a_n = n + a_{n-1}$ then sum of first two terms S_2 is:
   ◯ 0 ◯ 1 ◯ −1 ◯ 2

10. If b is a harmonic mean between -2 and 4 then $b=...$ ◯ 8 ◯ -8 ◯ 1 ◯ -1

11. $\binom{8}{7}+\binom{8}{6}=$ ◯ 72 ◯ 48 ◯ 63 ◯ 36

12. If a fair die is rolled, then what is the probability that the top is an even number? ◯ $\frac{1}{2}$ ◯ $\frac{1}{3}$ ◯ $\frac{1}{6}$ ◯ 1

13. Which of the following expressions is sum of the series $1-x+x^2-x^3+...$ ◯ $\frac{1}{1+x}$ ◯ $\frac{1}{1-x}$ ◯ $\sqrt{1+x}$ ◯ $\frac{1}{\sqrt{1-x}}$

14. What is the length of the arc that subtends an angle of measure $60°$ at the centre of a circle with radius 6? ◯ 3π ◯ 2π ◯ 6π ◯ π

15. $\sin\left(\frac{7\pi}{6}\right)=$ ◯ $-\frac{\sqrt{3}}{2}$ ◯ $-\frac{1}{2}$ ◯ $\frac{1}{2}$ ◯ $\frac{\sqrt{3}}{2}$

16. Which of the following trigonometric expressions is identically equal to $1-\cos 2\theta$ ◯ $2\cos^2\theta$ ◯ $2\sin^2\theta$ ◯ $2\sin^2 2\theta$ ◯ $2\cos^2 2\theta$

17. What is the primary period of $\tan\left(\frac{x}{3}\right)$? ◯ 3π ◯ $\frac{\pi}{3}$ ◯ $\frac{\pi}{2}$ ◯ π

18. The circumradius R of a triangle with sides a,b,c is equal to: ◯ $\frac{abc}{\Delta}$ ◯ $\frac{abc}{4\Delta}$ ◯ $\frac{4abc}{\Delta}$ ◯ $\frac{4\Delta}{abc}$

19. For what value of x, $\tan(x-30°)=\cot x$ ◯ 90° ◯ 60° ◯ 120° ◯ 150°

20. What is the solution of $\sec x=2$ in the interval $[0,\pi]$? ◯ $\left\{-\frac{\pi}{6}\right\}$ ◯ $\left\{-\frac{\pi}{3}\right\}$ ◯ $\left\{\frac{\pi}{3}\right\}$ ◯ $\left\{\frac{\pi}{6}\right\}$

ROLL NUMBER					

MATHEMATICS HSSC–I

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

NOTE: Attempt any twelve parts from Section 'B' and any four 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 48)

Q. 2 Attempt any TWELVE parts. All parts carry equal marks. **(12 x 4 = 48)**

(i) Simplify $\frac{9}{\sqrt{5}+\sqrt{-4}}$ in the form of $a+bi$

(ii) If U = the set of the English alphabets, A and B are subsets of U, where $A=\{x \mid x \text{ is a vowel}\}$, $B=\{y \mid y \text{ is a consonant}\}$, then verify the de Morgan's Laws (i) $(A\cup B)'=A'\cap B'$ (ii) $(A\cap B)'=A'\cup B'$

(iii) Construct the truth table for the biconditional $p\leftrightarrow q$

(iv) If $A=\begin{bmatrix}1 & 1+i & i\end{bmatrix}$, then find $\left(\overline{A}\right)' A$

(v) Without expansion, show that $\begin{vmatrix}2 & 3 & -1\\ 1 & 1 & 0\\ 2 & -3 & 5\end{vmatrix}=0$

(vi) Find the numerical value of k if polynomial x^3+kx^2-7x+6 has remainder 4 when divided by $x-2$

(vii) Find the two consecutive numbers whose product is 72

(viii) If $5, 8$ are two arithmetic means between a and b, then find a and b

(ix) Find $9th$ term of the hormonic sequence $-\frac{1}{5},-\frac{1}{3},-1,...$

(x) Find values of n and r, when ${}^nC_r=56$ and ${}^nP_r=336$

(xi) If x is so small that its square and higher powers can be neglected, then show that $\frac{\sqrt{4+x}}{(1+x)^3}\cong 2-\frac{23}{4}x$

(xii) Show that the area of a sector of a circular region of radius r is $\frac{1}{2}r^2\theta$, where θ is the circular measure of the central angle of the sector.

(xiii) If $\cot\theta=\frac{4}{3}$ and the terminal arm of the angle is not in the quadrant-I, find the values of $\cos\theta$ and $\operatorname{cosec}\theta$

(xiv) Show that $\frac{\cos(\pi+\theta)\sec(\pi-\theta)}{\sin^2(\pi+\theta)\cdot\tan(\pi-\theta)}=-\cot\theta\cdot\operatorname{cosec}^2\theta$

(xv) Prove that $\cot 2x=\frac{\sin x-\sin 3x}{\cos 3x-\cos x}$

(xvi) Show that $\tan^{-1}\left(\frac{27}{11}\right)-\tan^{-1}\frac{8}{19}=\frac{\pi}{4}$

SECTION – C (Marks 32)

Note: Attempt any FOUR questions. All questions carry equal marks. **(4 x 8 = 32)**

Q. 3 Solve the following system by reducing their augmented matrix to the echelon form
$$x_1+4x_2+2x_3=2$$
$$2x_1+x_2-2x_3=9$$
$$2x_1+2x_2-2x_3=12$$

Q. 4 Solve the system of simultaneous equations:
$$3x+2y=7$$
$$3x^2=25+2y^2$$

Q. 5 (a) Resolve $\frac{2x^4}{(x+3)(x-2)^2}$ into partial fractions

(b) Find the sum S_n of the Arithmetic Series $a+(a+d)+(a+2d)+...+(a+(n-1)d)$

Q. 6 Find the sum of the following series to n-terms: $1+(1+2)+(1+2+3)+...$

Q. 7 If $2y=\frac{1}{2^2}+\frac{1\cdot 3}{2!}\frac{1}{2^4}+\frac{1\cdot 3\cdot 5}{3!}\frac{1}{2^6}+...$ then prove that $4y^2+4y-1=0$

Q. 8 Without using calculator/table prove that $\sin 10°\sin 30°\sin 50°\sin 70°=\frac{1}{16}$

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MATHEMATICS HSSC–I

SECTION – A (Marks 20)

Time allowed: 25 Minutes

حصہ اوّل لازمی ہے۔ اس کے جوابات اسی صفحہ پر دے کر ناظم مرکز کے حوالے کریں۔ کاٹ کر دوبارہ لکھنے کی اجازت نہیں ہے۔ لیڈ پنسل کا استعمال ممنوع ہے۔

Fill the relevant bubble against each question:

ہر سوال کے سامنے دیے گئے درست دائرہ کو پُر کریں۔

1. If a,b,c are real numbers such that $a<b$, $c<0$, $a\neq 0$, $b\neq 0$, then which of the following inequalities holds:
   ◯ $ac>bc$ ◯ $ac^2>bc^2$ ◯ $\frac{c}{a}>\frac{c}{b}$ ◯ $ac<bc$

2. What is the converse of $p\rightarrow q$?
   ◯ $\sim p\rightarrow q$ ◯ $q\rightarrow p$ ◯ $\sim q\rightarrow\sim p$ ◯ $p\leftrightarrow q$

3. The set of non-zero rational numbers is a group under the operation of:
   ◯ Addition ◯ Subtraction ◯ Multiplication ◯ Division

4. For what value of λ is the matrix $\begin{bmatrix}1&0&0\\2&\lambda&0\\1&2&3\end{bmatrix}$ singular?
   ◯ 1 ◯ 0 ◯ 3 ◯ –4

5. If A is a skew-symmetric matrix then:
   ◯ $A=A^t$ ◯ $A=-A^t$ ◯ $A=(\bar{A})^t$ ◯ $A=-(\bar{A})^t$

6. If the polynomial $f(x)$ is divided by $x+2$, the quotient is $x-2$ and the remainder is 2, then $f(x)$ will be:
   ◯ x^2-4 ◯ x^2+4 ◯ x^2-2 ◯ x^2+2

7. If w is a cube root of unity, then which of the following equations is true?
   ◯ $1+w=0$ ◯ $1+w^2=0$ ◯ $w+w^2=0$ ◯ $1+w+w^2=0$

8. What is the partial fractions of $\frac{x^2+2x-1}{x^2-1}$?
   ◯ $1+\frac{1}{x+1}-\frac{1}{x-1}$ ◯ $1+\frac{1}{x-1}-\frac{1}{x+1}$ ◯ $1-\frac{1}{x+1}-\frac{1}{x-1}$ ◯ $1+\frac{1}{x-1}+\frac{1}{x+1}$

9. Find the second term of the sequence whose general term is $a_n=2n^2-3$
   ◯ –1 ◯ 13 ◯ 5 ◯ 11

10. If $s_\infty = \frac{2}{3}$ and $a = \frac{2}{7}$ in an infinite geometric progression, then the common ratio is:	○ $-\frac{4}{7}$	○ $\frac{4}{7}$	○ $\frac{2}{7}$	○ $-\frac{2}{7}$
11. For what values of x, the binomial expansion of $\left(1-\frac{x}{2}\right)^{-1}$ is convergent (valid)?	○ $x>2$	○ $\lvert x\rvert>2$	○ $\lvert x\rvert<2$	○ $x<1$
12. What is radius of the circle whose part of arc-length of measure 4 is with central angle $\frac{\pi}{2}$?	○ $\frac{8}{\pi}$	○ $\frac{4}{\pi}$	○ $\frac{2}{\pi}$	○ $\frac{\pi}{2}$
13. If $D\left(-5,5\sqrt{2}\right)$ lies on the terminal side of θ, then find the value of $\tan\theta$	○ $-\frac{1}{\sqrt{2}}$	○ $\frac{1}{\sqrt{2}}$	○ $\sqrt{2}$	○ $-\sqrt{2}$
14. If ${}^nC_4 = {}^nC_{10}$, then $n=\ldots$	○ 4	○ 10	○ 14	○ 6
15. How many distinct three-digit numbers can be formed from the integers 1,2,3,4,5,6 if each digit is used at most once?	○ 360	○ 120	○ 20	○ 10
16. What is the middle term in the expansion of $\left(x+x^{-1}\right)^{14}$	○ $6th$ term	○ $7th$ term	○ $8th$ term	○ $9th$ term
17. $\sin\left(\frac{3\pi}{2}-\alpha\right)=$	○ $\sin\alpha$	○ $\cos\alpha$	○ $-\sin\alpha$	○ $-\cos\alpha$
18. What is the primary period of $\frac{\sin 2x}{1+\cos 2x}$	○ 2π	○ π	○ $\frac{\pi}{2}$	○ 4π
19. A ladder makes angle $30°$ with the wall of height $8m$. What is the length of the ladder?	○ $16m$	○ $8m$	○ $4m$	○ $12m$
20. What is the value of $\sin^{-1}\left(-\frac{1}{2}\right)$?	○ $-\frac{\pi}{6}$	○ $\frac{\pi}{6}$	○ $-\frac{\pi}{3}$	○ $\frac{\pi}{3}$

ROLL NUMBER					

MATHEMATICS HSSC–I

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

NOTE: Attempt any twelve parts from Section 'B' and any four 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 48)

Q. 2 Attempt any TWELVE parts. All parts carry equal marks. **(12 x 4 = 48)**

(i) Separate $\frac{(2-3i)^2}{1-i}$ into real and imaginary parts.

(ii) Determine whether $p \to (q \to p)$ is a tautology, a contingency or an absurdity.

(iii) If $A = \{1,2,3,4\}$, state the domain and range of the relation $R = \{(x,y) \mid x+y=5\}$

(iv) Under the operation "*", complete the following table to obtain a semigroup

*	a	b	c
a	c	a	b
b	...	...	c
c	b	c	a

(v) Find the matrix A if $\begin{bmatrix} 2 & -1 \\ -1 & 2 \end{bmatrix} A = \begin{bmatrix} 0 & -3 & 8 \\ 3 & 3 & -7 \end{bmatrix}$

(vi) Find the inverse of matrix $A = \begin{bmatrix} 2i & i \\ i & -i \end{bmatrix}$, hence show that $AA^{-1} = I_2$

(vii) If α, β are roots of $3x^2 - 2x + 4 = 0$, then find the value of $\frac{\alpha}{\beta} + \frac{\beta}{\alpha}$

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

(ix) If $y = 1 - \frac{x}{2} + \frac{x^2}{4} - \ldots$, then show that $x = 2\left(\frac{1-y}{y}\right)$

(x) Find values of n and r, when ${}^nC_r = 10$ and ${}^nP_r = 60$.

(xi) There are 9 green and 6 red balls in a box. A ball is drawn (taken out). What is the probability that (i) the ball is green (ii) the ball is red.

(xii) Expand and simplify $(2+i)^4 - (2-i)^4$

(xiii) Find the remaining trigonometric functions if $\cos\theta = -\frac{1}{2}$ and the terminal arm of angle θ is in quad-III.

(xiv) Show that $\frac{\sin(\alpha-\beta)}{\sin(\alpha+\beta)} = \frac{\tan\alpha - \tan\beta}{\tan\alpha + \tan\beta}$

(xv) Find the measure of smallest angle of the triangle whose sides are 16, 20 and 33

(xvi) Show that $2\cos^{-1}\frac{4}{5} = \sin^{-1}\frac{24}{25}$

SECTION – C (Marks 32)

Note: Attempt any FOUR questions. All questions carry equal marks. **(4 x 8 = 32)**

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

Q. 4 Find the value of λ for which the system $\begin{aligned} x+y+z &= 0 \\ 2x+y-\lambda z &= 0 \\ x+2y-2z &= 0 \end{aligned}$ has a non-trivial solution. Also solve the system for that value of λ

Q. 5 **(a)** Resolve $\frac{x^2}{(x^2+4)(x+2)}$ into partial fractions **(b)** Prove that ${}^nC_k + {}^nC_{k-1} = {}^{n+1}C_k$

Q. 6 Expand $(1-2x)^{\frac{1}{3}}$ to four terms and apply it to evaluate $(0.8)^{\frac{1}{3}}$ correct to three places of decimal.

Q. 7 If $\sin\alpha = \frac{4}{5}$ and $\sin\beta = \frac{12}{13}$, where $\frac{\pi}{2} < \alpha < \pi$ and $\frac{\pi}{2} < \beta < \pi$. Find (i) $\cos(\alpha+\beta)$ (ii) $\sin(\alpha-\beta)$

Q. 8 **(a)** Show that $R = \frac{abc}{4\Delta}$

(b) Solve the equation $\sqrt{3}\tan x - \sec x - 1 = 0$ for its general solution