Version No.			

ROLL NUMBER						

Answer Sheet No._____

Sign. of Candidate _____

Sign. of Invigilator _____

MATHEMATICS HSSC–I (3rd Set)

SECTION – A (Marks 20)

Time allowed: 25 Minutes

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.**

Q.1 Fill the relevant bubble for each part. All parts carry one mark.

(1) What is simplest form of $\left[\sqrt{2}(1-i)\right]^4$?

A. 16 ◯ B. -16 ◯

C. 8 ◯ D. -8 ◯

(2) Logically $\sim (p \leftrightarrow q)$ is equivalent to:

A. $q \leftrightarrow p$ ◯ B. $p \leftrightarrow \sim q$ ◯

C. $\sim q \leftrightarrow \sim q$ ◯ D. $\sim p \leftrightarrow \sim q$ ◯

(3) Under which of the following operations, the set $A = \{-1,0,1\}$ is closed?

A. Addition ◯ B. Subtraction ◯

C. Multiplication ◯ D. Division ◯

(4) Rank of matrix $A = \begin{bmatrix} 1 & 0 & 0 \\ -3 & 1 & 0 \\ 2 & 2 & 1 \end{bmatrix}$ is:

A. 1 ◯ B. 3 ◯

C. 2 ◯ D. 4 ◯

(5) Which of the following represents the root of equation $x^4 - 1 = 0$?

A. $1, -1, w, w^2$ ◯ B. $1, -1, i, -i$ ◯

C. $0,1, -w, -w^2$ ◯ D. $2, -2, 2i, -2i$ ◯

(6) What is the solution of $2^{2x} - 3 \times 2^{x+2} + 32 = 0$?

A. $\{2,3\}$ ◯ B. $\{-2,3\}$ ◯

C. $\{2, -3\}$ ◯ D. $\{-2, -3\}$ ◯

(7) The partial fraction of $\frac{6+7x}{x^3+8}$ will be in the form:

A. $\frac{A}{x+2} + \frac{Bx+C}{x^2-2x+4}$ ◯ B. $\frac{A}{x-2} + \frac{Bx+C}{x^2+2x+4}$ ◯

C. $\frac{A}{x+2} + \frac{Bx+C}{x^2+2x+4}$ ◯ D. $\frac{A}{x+2} + \frac{Bx+C}{x^2+4}$ ◯

(8) For what value of k, if $\frac{1}{2}, \frac{1}{k-1}, \frac{1}{6}$ are in A.P

A. 2 ◯ B. 3 ◯

C. 4 ◯ D. 5 ◯

(9) What will be the value of $\sum_{k=1}^{n} k^3$?

A. $\frac{n(n+1)}{2}$ ◯ B. $\frac{n(n+1)(2n+1)}{6}$ ◯

C. $\frac{n^2(n+1)^2}{4}$ ◯ D. $\frac{n^2(n-1)}{2}$ ◯

(10) What will be the probability of getting a number between 1 and 50 that is divisible by 1 and the number itself?

A. 0.3 ◯ B. 0.35 ◯

C. 0.40 ◯ D. 0.32 ◯

(11) For any natural number n, $7^n - 3^n$ is divisible by:

A. 3 ◯ B. 4 ◯

C. 5 ◯ D. 7 ◯

(12) In the expansion of $(1+x)^{60}$, the sum of coefficient of odd power of x is:

A. 2^{60} ◯ B. 2^{59} ◯

C. 2^{61} ◯ D. 2^{120} ◯

(13) Which one of the following is the simplified form of $(1-\sin x)\left(1+\frac{1}{\sin x}\right)$?

A. $\sin x \cos x$ ◯ B. $\sin x \tan x$ ◯

C. $\cos x \cot x$ ◯ D. $\csc x \cot x$ ◯

(14) Which are Co-terminal angles?

A. $\frac{\pi}{3}, \frac{4\pi}{3}$ ◯ B. $\frac{\pi}{3}, \frac{5\pi}{3}$ ◯

C. $\frac{\pi}{3}, \frac{13\pi}{3}$ ◯ D. $\frac{\pi}{3}, \frac{17\pi}{3}$ ◯

(15) If $\cos 47^\circ = z$, express $\cos 94^\circ$ in term of z

A. $2z\sqrt{1-z^2}$ ◯ B. $2z^2 - 1$ ◯

C. $2z^2 + 1$ ◯ D. $2z\sqrt{z^2-1}$ ◯

(16) What is the domain of $y = 3tan4x$?

A. $R - \left\{(2n+1)\frac{\pi}{2}; n \in Z\right\}$ ◯ B. $R - \left\{(2n+1)\frac{\pi}{6}; n \in Z\right\}$ ◯

C. $R - \left\{(2n+1)\frac{\pi}{8}; n \in Z\right\}$ ◯ D. R ◯

(17) If area of $\Delta ABC = 41.6$, $a = 6, b = 18$ then $\angle C$ is:

A. $50^\circ 23'$ ◯ B. $23^\circ 39'$ ◯

C. $39^\circ 36'$ ◯ D. $37^\circ 36'$ ◯

(18) What is the angle of elevation of the sun when 10m high pole cast a shadow of 8m?

A. $52^\circ 7'$ ◯ B. $51^\circ 20'$ ◯

C. $53^\circ 20'$ ◯ D. $54^\circ 6'$ ◯

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

A. 0 ◯ B. $\frac{1}{\sqrt{2}}$ ◯

C. $-\frac{1}{\sqrt{2}}$ ◯ D. 1 ◯

(20) Solution set of $secx = -\frac{2}{\sqrt{3}}$ is:

A. $\left\{\frac{\pi}{6} + 2n\pi\right\} \cup \left\{\frac{5\pi}{6} + 2n\pi\right\}$ ◯ B. $\left\{\frac{\pi}{3} + 2n\pi\right\} \cup \left\{\frac{5\pi}{3} + 2n\pi\right\}$ ◯

C. $\left\{\frac{5\pi}{3} + 2n\pi\right\} \cup \left\{\frac{7\pi}{3} + 2n\pi\right\}$ ◯ D. $\left\{\frac{5\pi}{6} + 2n\pi\right\} \cup \left\{\frac{7\pi}{6} + 2n\pi\right\}$ ◯

Federal Board HSSC-I Examination
Mathematics Model Question Paper
(Curriculum 2000)

Time allowed: 2.35 hours Total Marks: 80

Note: Sections 'B' and 'C' comprise pages 1-2 and questions therein are to be answered on the separately provided Answer Book. Write your answers neatly and legibly.

SECTION – B (Marks 48)

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

i. If $Z = \frac{5-3i}{1+i}$, then find:
   a. Modulus of the complex number
   b. Argument of complex number

ii. Show that the set $G = \{a + b\sqrt{5}; a, b \in Q\}$ is a group with respect to addition

iii. If $\begin{vmatrix} 4 & 4 & 4 & m \\ 4 & 4 & m & 4 \\ 4 & m & 4 & 4 \\ m & 4 & 4 & 4 \end{vmatrix} = 0$, find values of m.

iv. Find the values of s and t if -2 and 2 are the roots of the polynomial $x^3 - 8sx^2 - 4tx + 9$.

v. If α, β are the roots of $x^2 - 3x + 2 = 0$, form the equation whose roots are $\left(1 + \frac{3}{\alpha}\right) and \left(1 + \frac{3}{\beta}\right)$

vi. Resolve $\frac{7-3x+x^2}{(1-x)^2(3+x)}$ into partial fraction

vii. In an A.P, first term is 74 and common difference is -6.
   a. Show that sum of first n term is $n(77 - 3n)$
   b. Find the values of n, If $S_n = 380$

viii. The 2nd term of G.P is $\frac{1}{4}$ and sum up to infinity of the series is 2.
   Find the first term and common ratio of the series.

ix. How many numbers greater then 2000,000 can be formed from the digits 0,2,2,2,3,4,4?

x. One card is selected from a deck of 52 playing cards. What is the probability that the card is either a heart or a face card?

xi. Find the unknowns k and n, If $(1 - kx)^n = 1 - 10x + 60x^2 +$----

xii. Prove the identity $\frac{24\cos\theta - 5\sin^2\theta}{\cos^2\theta + 5\cos\theta} = 5 - \sec\theta$

xiii. Prove that $\frac{1-\cos 2x+\sin 2x}{1+\cos 2x+\sin 2x} = \tan x$

xiv. The sides of a triangle are $a + d, a + 2d, a + 3d$.
   Prove that $\cos\gamma = \frac{a}{2(a+d)} - \frac{d}{(a+d)}$.

xv. Solve $\tan^{-1}\left(\frac{1+\frac{x}{2}}{1-\frac{x}{2}}\right)+\tan^{-1}\frac{x}{2}$

xvi. Find the solution set of $2\cos 2\theta = -3-4\cos\theta$ in the interval $[0,2\pi]$

SECTION – C (Marks 32)

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

Q.3 If $A=\begin{bmatrix}1 & 2 & 3\\ 2 & 5 & 3\\ 1 & 0 & 8\end{bmatrix}$ then find A^{-1} using row/column operations.

Q.4 a. A committee of 5 members is to be selected from 6 men and 4 women. Find the number of ways if

i. the committee has exactly 3 men and

ii. the committee has at least 2 women

b. A fair coin and a die are tossed. Let A be the event 'tail appear on the coin' and B be the event 4 on the die, check whether A and B are independent events or not

Q.5 Find the following in the expansion of $\left(\frac{3y^2}{2}-\frac{1}{3y}\right)^6$

i. The term involving y^3 ii. The term independent of y

iii. The middle term

Q.6 State and prove the Fundamental Law of Trigonometry.

Q.7 If $y = 3\cos x$ where $-2\pi \le x \le 2\pi$, then

a. write down the period and

b. sketch the graph of the given trigonometric function.

Q.8 Prove that $\cos^{-1}\left(\frac{3}{5}\right)-2\tan^{-1}\left(\frac{3}{4}\right)=\cos^{-1}\left(\frac{117}{125}\right)$

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MATHEMATICS HSSC-I (3rd Set)

Student Learning Outcomes Alignment Chart

National Curriculum 2000

Sec-A	Q 1	Contents and Scope	Student Learning Outcomes
	i	• . Concept of Complex Numbers and Basic Operations on them. Conjugate and its properties.	• to know four binary operations on complex numbers (distinct and repeated) and their properties (commutative, associative and distributive);
	ii	• Logical Proofs of the Operation on Sets	• Introduction to the logical statements (simple and compound) and their composition (common connectives, negation, conjunction, disjunction, conditional and biconditional); truth values and truth tables of logical statements and their logical equivalence
	iii	• Binary Operations and its Different Properties	• To have the concept of a binary operation on a set and the idea of algebraic system; to know the properties of binary operations (closure, commutative, non-commutative, associative, non-associative, existence of identity and inverse in an algebraic system with respect to a given binary operation) Addition modulo and multiplication modulo be introduced.
	iv	• Determinants and their Application in the study of the Algebra of Matrices	• To know the elementary row and column operations on matrix, To define the following types of matrices: Upper and lower triangular, symmetric and skew-symmetric, Hermitain and skew-hermitian and echelon and reduced echelon forms; to reduce a matrix to its echelon or reduced echelon form and be able to apply them in finding the inverse and rank (rank of matrix to be taken as number of non zero rows of the matrix in echelon form) of a matrix upto order 3 x 3
	v	• Cube roots and Fourth Roots of unity	• To find cube roots and fourth roots of unity and their properties ω and ω2 to be introduced as complex cube roots of unity
	vi	• Solution of Equations Reducible to Quadratic Equations in one Variable	• To solve equation reducible to quadratic equations in one variable .
	vii	• Partial Fractions	• To reduce a fraction into partial fractions when its denominate consists of a) Linear factor • Non-repeated quadratic factor.
	viii	• Arithmetic sequence	• To have the concept of an arithmetic mean (A.M) and of n arithmetic means between two numbers: to be able to find a A.M and to insert n AMs between two numbers
	ix	Sum of series	• To know the meaning of the symbol $\sum n, \sum n^2, \sum n^3$ and apply them in evaluating the sum of series.
	x	• Probability (Basic Concepts and Estimation of Probability)	• To know the formula for finding the probability; To apply the formula for finding probability in simple cases.

	xi	Application of Mathematical Induction.	• To know the principle of mathematical induction and its various applications.
	xii	Binomial Theorem for Positive Integral Index.	• Find the number of terms and general terms in the expansion of $(a+b)^n$ and apply it to expand positive integral powers of the binomials and find their particular terms.
	xiii	• Trigonometric Functions	• To establish the following relations between the trigonometric ratios; *cosec θ= 1/ sin θ, sec θ = 1/con θ,* *cot θ = 1/tan θ , tan θ = sin θ / cos θ* *cot θ= cos θ/sin θ, $sin^2\theta + cos^2\theta = 1$,* *$1 + tan^2\theta = sec^2\theta$ and* *$1 + cot^2\theta = cosec^2\theta$:* to be able to apply the above mentioned relations in b) proving the trigonometric identities;
	xiv	• Units of Measures of Angles.	• to have the concept of the measure of an angle as the amount of rotation including the senses of clock wise and anti-clock wise rotation so as to have the idea of general angle and circular residue.
	xv	• Trigonometric Ratios of Double Angles and Half Angles	• To find the values of the trigonometric ratios of double and half the angles and apply them.
	xvi	• Periods of Trigonometric Functions	• To know the domains and ranges of the trigonometric functions to have the concept of period of a trigonometric function and the period of the basic trigonometric functions.
	xvii	• Areas of Triangular Regions.	• To establish and apply the formula for finding the areas of triangular regions; $\Delta = \frac{1}{2}ab\sin\gamma$
	xviii	• Heights and Distances	• To be able to use solution of right triangles in solving the problems of heights and distances.
	xix	• Inverse Trigonometric Functions	• To know the general and principle trigonometric functions their inverses and their values.
	xx	• Solution of Trigonometric Functions	• To solve trigonometric equations and check their answers by substitution in the given equations so as to discard extraneous roots and to make use of the period of trigonometric functions for finding the general solution of the equations.
Sec-B	**Q 2**		
	i	• Concept of Complex Numbers and Basic Operations on them. Conjugate and its properties. Modulus (absolute value) and its properties • Geometrical Representation of Complex numbers by Argand's Diagram.	• To know the conjugate and modulus of a complex number $z = x + iy$ • To know that for complex numbers $x + iy, x = r\cos\theta, y = r\sin\theta$ where r is modulus and θ is called argument.

	ii	• Groups	• To know the definitions of a group, a semi group, a monoid and a group.
	iii	Determinants and their Application	• Concept of a determinant of a square matrix expansion of the determinants up to order 4 (simple cases)
	iv	• Application of Remainder Theorem in the Solution of Equations	• To use synthetic division in finding depressed equations for solving them.
	v	• Formation of Quadratic Equations from Given Conditions	• To form quadratic equations in one variable whose roots are related in various ways with the roots of given quadratic equation
	vi	• Partial Fractions	• To define proper and improper rational fraction, to distinguish identities from conditional equations, to reduce a fraction into partial fractions when its denominate consists of a) Linear factors b) Repeated linear factors (at the most cubes)
	vii	• Arithmetic sequence	• To solve problems pertaining to the terms of an A.P.
	viii	• Geometric Series	• To establish the formulas for finding the sum of geometric series upto *n* terms and to infinity .
	ix	• Permutations	• To establish the formula for ${}^{n}P_{r}$ and apply it in solving problems of finding the number of arrangements of n things taken r at a time (when some of them are alike)
	x	• Addition of Probability	• Know the following rules $P(S) = 1\ ,\ P(\emptyset) = 0\ ,\ 0 \leq P(E) \leq 1$ $P(E) = n(E)/n(S)$ • If X and Y are not compliments of each other, then $P(X \cup Y) = P(X) + P(Y) - P(X \cap Y)$
	xi	• Binomial Series	• To be able to identify given series as a binomial expansion .
	xii	• Trigonometric Functions	• To establish the following relations between the trigonometric ratios; $\csc\theta = 1/\sin\theta,\ \sec\theta = 1/\cos\theta,$ $\cot\theta = 1/\tan\theta\ ,\ \tan\theta = \sin\theta/\cos\theta$ $\cot\theta = \cos\theta/\sin\theta,\ \sin^2\theta + \cos^2\theta = 1,$ $1 + \tan^2\theta = \sec^2\theta$ and $1 + \cot^2\theta = \operatorname{cosec}^2\theta$: to be able to apply the above mentioned relations in b) Proving the trigonometric identities.
	xiii	• Trigonometric Ratios of Double Angles and Half Angles	• To find the values of the trigonometric ratios of double and half the angles and apply them.
	xiv	• Cosine Formula	• To establish the cosine formula and apply it in the solution of oblique triangles
	xv	• Inverse Trigonometric Functions	• Development of formulas for inverse trigonometric functions and their application.
	xvi	• Solution of Trigonometric Functions	• To solve trigonometric equations and check their answers by substitution in the given equations so as to discard extraneous roots and to make use of the period of trigonometric

			functions for finding the general solution of the equations.
Sec-C	**Q No**		
	3	• Types of Matrices and the Row and Column Operations on Matrices	• To know the elementary row and column operations on matrix, To define the following types of matrices: Upper and lower triangular, symmetric and skew-symmetric, Hermitain and skew-hermitian and echelon and reduced echelon forms; to reduce a matrix to its echelon or reduced echelon form and be able to apply them in finding the inverse and rank (rank of matrix to be taken as number of non zero rows of the matrix in echelon form) of a matrix upto order 3 x 3
	4	• Combinations • Addition and Multiplication of Probability	• To apply combination in solving problems • Know the following rules $P(S) = 1$, $P(\emptyset) = 0$, $0 \leq P(E) \leq 1$ $P(E) = n(E)/n(S)$ d) If X and Y are independent events, then $P(X \cap Y) = P(X) \times P(Y)$
	5	• Binomial Theorem for Positive Integral Index	• To state and prove the binomial theorem for positive integral index, find the number of terms and general terms in the expansion of $(a+b)^n$ and apply it to expand positive integral powers of the binomials and find their particular terms (without expansion).
	6	• Periods of Trigonometric Functions • Graphs of Trigonometric Functions	• To know the domains and ranges of the trigonometric functions to have the concept of period of a trigonometric function and the period of the basic trigonometric functions. • To draw the graphs of the six basic trigonometric function sin the domains ranging from -2π to 2π and know that the graphs of these trigonometric functions are repeated depending upon the period of the functions
	7	• Fundamental Formulas of Sum and Difference of two Angles and their Application	• a) Informal introduction of distance formula; b) to establish the formula: $\cos(\alpha-\beta) = \cos\alpha\cos\beta + \sin\alpha\sin\beta$
	8	• Inverse Trigonometric Functions	• To know the definition of inverse trigonometric functions their domains and ranges; to know the general and principle trigonometric functions their inverses and their values; development of formulas for inverse trigonometric functions and their application.

MATHEMATICS HSSC-I (3rd Set)

Table of Specification

Topics	1. Number Systems	2. Sets, Functions and Groups	3. Matrices and Determinants	4. Quadratic Equations	5. Partial Fractions	6. Sequences and Series	7. Permutation, Combination and Probability	8. Mathematical Inductions and Binomial Theorem	9. Fundamentals of Trigonometry	10. Trigonometric Identities	11. Fundamentals of Trigonometry	12. Application of Trigonometry	13. Inverse Trigonometric Functions	14. Solution of Trigonometric Equations	Total marks for each assessment objective	% age
Knowledge based	1(1)(1)	1(2)(1) 2ii(4) 1(10)(1)		2iv(4) 2v(4)	1(7)(1)	1(9)(1) 2vii(4) 2viii(4)		1(11)(1)	1(14)(1)	6(8)	7(2)				37	28%
Comprehension based	2i(4)		1(4)(1) 2iii(4) 3(8)	1(5)(1) 1(6)(1)	2vi(4)	1(8)(1)	1(10)(1) 2x(4) 4(4)	2xi(4) 5(8)		1(15)(1)	1(16)(1) 7(2)	2xiv(4)	1(19)(1) 8(8)	2xvi(4) 1(20)(1)	67	50.8%
Application based							2ix(4) 4(4)	1(12)(1)	1(13)(1) 2xii(4)	2xiii(4)	7(4)	1(17)(1) 1(18)(1)	2xv(4)		28	21.2%
Total marks for each topic	05	06	13	10	05	10	17	14	06	13	09	06	13	05	132	100%

KEY:

1(1)(01)

Question No (Part No.) (Allocated Marks)

Note: (i) The policy of FBISE for knowledge based questions, understanding based questions and application based questions is approximately as follows:

a) 30% knowledge based.
b) 50% understanding based.
c) 20% application based.

(ii) The total marks specified for each unit/content in the table of specification is only related to this model question paper.

(iii) The level of difficulty of the paper is approximately as follows:

a) 40% easy
b) 40% moderate
c) 20% difficult