

Version No.			

ROLL NUMBER						



0	0	0	0
1	1	1	1
2	2	2	2
3	3	3	3
4	4	4	4
5	5	5	5
6	6	6	6
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9	9	9	9

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1	1	1	1	1	1	1
2	2	2	2	2	2	2
3	3	3	3	3	3	3
4	4	4	4	4	4	4
5	5	5	5	5	5	5
6	6	6	6	6	6	6
7	7	7	7	7	7	7
8	8	8	8	8	8	8
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Answer Sheet No. _____

Sign. of Candidate _____

Sign. of Invigilator _____

MODEL QUESTION PAPER (SET – I)
MATHEMATICS HSSC–I (Based on Curriculum 2006)

SECTION – A (Marks 20)
Time allowed: 25 Minutes

Section – A is compulsory and comprises pages 1-2. All parts of this section are to be answered on the question papers 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.

(1) Complex number $\frac{1}{(2-i)^2}$, in the form $a + ib$ is:

A) $\frac{3}{25} + \frac{4}{25}i$

B) $\frac{3}{25} - \frac{4}{25}i$

C) $-\frac{4}{25} - \frac{3}{25}i$

D) $\frac{4}{25} - \frac{3}{25}i$

(2) What is the conjugate of $(1 + i)^3$?

A) $-2 + 2i$

B) $-2 - 2i$

C) $2 + 2i$

D) $2 - 2i$

(3) For what value of k , $\begin{vmatrix} 2 & -1 & k \\ 3 & 1 & 2 \\ -1 & 3 & -2 \end{vmatrix} = 0$?

A) -2

B) 0

C) 1.2

D) 2

(4) What is the row rank of a matrix $\begin{bmatrix} 1 & 3 & 5 \\ 4 & 5 & 5 \\ 1 & 2 & 2 \end{bmatrix}$?

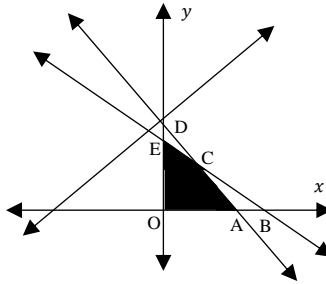
A) 0

B) 1

C) 2

D) 3

- (14) Which of the following are the corner points of the feasible region shown?



- A) O, A, B, C, D, E B) O, A, C, E
 C) A, C, E D) A, B, C, D, E
- (15) If $\alpha + \beta + \gamma = 180^\circ$ then $\operatorname{cosec} \alpha (\cos \beta \cos \gamma - \sin \beta \sin \gamma)$ is equal to:
- A) $-\cot \alpha$ B) $\tan \alpha$
 C) $\cot \alpha$ D) $\csc \alpha$
- (16) Which of the following represents $2 \cos 75^\circ \cos 15^\circ$?
- A) $\frac{\sqrt{3}}{\sqrt{2}}$ B) $\frac{1}{\sqrt{2}}$
 C) $\frac{1}{2}$ D) $\frac{\sqrt{3}}{2}$
- (17) Which of the following represents $\left(\sin \frac{\alpha}{2}\right) \left(\cos \frac{\alpha}{2}\right)$?
- A) $\frac{\Delta}{a^3}$ B) $\frac{\Delta}{ac}$
 C) $\frac{\Delta}{bc}$ D) $\frac{\Delta}{abc}$
- (18) In triangle ABC (with usual notations) if $a = \sqrt{3}$, $b = 3$ and $\beta = 60^\circ$, then value of α is:
- A) 30° B) 45°
 C) 60° D) 75°
- (19) Period of $\tan 3\theta$ is same as that of:
- A) $\sec 3\theta$ B) $\cot 6\theta$
 C) $\sin 6\theta$ D) $\tan 9\theta$
- (20) What is the range of a trigonometric function $y = -4 + 2\sin(3x + 5)$?
- A) $[-2, -6]$ B) $[-4, 2]$
 C) $[-4, 5]$ D) $[-6, -2]$



Federal Board HSSC-I Examination
MODEL QUESTION PAPER MATHEMATICS
(Based on Curriculum 2006)

Time allowed: 2:35 hours

Total Marks Section B and C: 80

Note: Answer all parts from Section 'B' and all questions from Section 'C' on the **E-sheet**.
Write your answers on the allotted/given spaces.

SECTION – B (Marks 48)

Q2. Attempt all parts. Each part carries **(04)** marks.

- (i) Solve the following simultaneous linear equations with complex coefficients.
 $3x - (2 + i)y = i + 7$; $(2i - 1)x + (3i - 2)y = 2i + 1$

- (ii) Use row operations to find the inverse of a square matrix $\begin{bmatrix} 2 & -1 & 3 \\ -1 & 2 & 3 \\ 1 & -1 & 2 \end{bmatrix}$

- (iii) Find angle between two vectors $\underline{a} = 2\underline{i} - \underline{j} + 5\underline{k}$ and $\underline{b} = 3\underline{i} + \underline{j} - \underline{k}$.

OR

Find area of a triangle whose vertices are $(-1, 2, 3)$, $(1, -2, 3)$ and $(1, 2, -3)$.

- (iv) Find two numbers whose harmonic mean is $\frac{24}{5}$ and geometric mean 6.

OR

Sum the series $1 \times 2^1 + 3 \times 2^2 + 5 \times 2^3 + 7 \times 2^4 + \dots + 99 \times 2^{50}$

- (v) If $5 \times P_3^n = 4 \times P_3^{n+1}$, find the value of n .

OR

In a factory, there are 100 units of a certain product, 5 of which are defective. If 3 units are selected from the 100 units at random, then what is the probability that none of them are defective?

- (vi) Using Principle of Mathematical Induction, prove that $n^2 \geq 3n + 5$ for all positive integers $n \geq 5$.

OR

Find a constant term in the expansion of $\left(2\sqrt{x} + \frac{3}{4\sqrt{x}}\right)^{10}$

- (vii) Find an equation of a parabola of the form $ax^2 + bx + c = 0$, which crosses x -axis at $(-8, 0)$ and $(4, 0)$ and a point $(-2, -6)$ lies on it.

- (viii) Graph the feasible region subject to the following constraints

$$6x - 8y \leq 12 \quad ; \quad 3x + 4y \geq 6 \quad ; \quad x \geq 0 \quad ; \quad y \geq 0$$

- (ix) Prove that $\cos 5\theta + 2 \cos 3\theta + \cos \theta = 4 \cos^2 \theta \cos 3\theta$

- (x) Find the interior angles of a triangle whose side measures are 5cm , 6cm and 7cm .

- (xi) In triangle ABC (with usual notations),

$$\text{prove that } \frac{s^2}{c} \left[\tan \frac{\alpha}{2} + \tan \frac{\beta}{2} \right] \left[\tan \frac{\alpha}{2} \tan \frac{\beta}{2} \right] = (s - c) \cot \frac{\gamma}{2}$$

- (xii) Prove that $\cot^{-1} \left(\frac{1}{3} \right) - 2 \tan^{-1} \left(\frac{2}{3} \right) = \cot^{-1} \left(\frac{41}{3} \right)$

OR

Solve: $2 \cos^4 x - 9 \cos^2 x + 4 = 0$ where $x \in [0, 2\pi]$

SECTION – C (Marks 32)

Note: Attempt **ALL** questions. Each question carries (08) marks.

- Q3.** Solve the following system of non-homogeneous linear equations using Gauss-Jordan method.
 $x + 5y + 3z = 7$; $2x + 3y + z = 6$; $3x - 2y + 2z = -3$
- Q4.** If 5, 7 and 9 are added to three consecutive terms of an A.P, the resulting numbers are in G.P. Find the numbers if their sum is 45.

- Q5.** If x is so small that its square and higher powers can be neglected, then show that

$$\frac{(1+x)^{\frac{3}{2}}(4-5x)^{\frac{1}{2}}}{(9+x)^{\frac{5}{2}}} \approx \frac{2}{243} \left(1 + \frac{43}{72}x\right)$$

OR

Find the maximum and minimum value of the function $f(x, y) = x + 3y$, subject to the following constraints

$$2x + y \geq 4 \quad ; \quad 2x + 3y \leq 12 \quad ; \quad x + 2y \leq 16 \quad ; \quad x \geq 0 \quad ; \quad y \geq 0$$

- Q6.** Prove that $24^\circ + \cos 48^\circ + \cos 96^\circ + \cos 168^\circ = \frac{1}{2}$.

OR

Solve graphically, the trigonometric equation: $\sin(2x) = -x$, where $x \in [0, 2\pi]$

MATHEMATICS HSSC-I

Student Learning Outcomes

(National Curriculum 2006)

Sec-A	Q1	Contents and Scope	Student Learning Outcomes *	Cognitive Level **	Allocated Marks
	<i>i</i>	1.1 Complex Numbers	(v) Define $\bar{z} = a - ib$ as the complex conjugate of $z = a + ib$.	K	1
	<i>ii</i>	1.1 Complex Numbers	(iv) Carryout basic operations on complex numbers.	U	1
	<i>iii</i>	2.3 Determinants	(iii) Define singular and non-singular matrices.	K	1
	<i>iv</i>	2.5 Row and Column Operations	(v) Use row operations to find the inverse and the rank of a matrix.	U	1
	<i>v</i>	3.1 Vectors in Plane	(iii) Give the following fundamental definitions using geometrical representation: • parallel vectors	K	1
	<i>vi</i>	3.5 Dot or Scalar Product 3.6 Cross or Vector Product	(viii) Use dot product to find the angle between two vectors. (viii) Use cross product to find the angle between two vectors.	K	1
	<i>vii</i>	4.4 Arithmetic Series	(ii) Establish the formula to find the sum to n terms of an arithmetic series.	U	1
	<i>viii</i>	4.9 Harmonic Mean	(i) Define a harmonic mean.	K	1
	<i>ix</i>	5.2 Arithmetico-Geometric Series	(i) Define arithmetico-geometric series	U	1
	<i>x</i>	6.2 Permutation	(v) Find the arrangement of different objects around a circle.	A	1
	<i>xi</i>	6.4 Probability	(ii) Recognize the formula for probability of occurrence of an event E, i.e. $P(E) = \frac{n(E)}{n(S)}, \quad 0 \leq P(E) \leq 1$	A	1
	<i>xii</i>	7.3 Binomial Series	(ii) Expand $(1 + x)^n$ in ascending powers of x and explain its validity/convergence for $ x < 1$ where n is a rational number.	A	1
	<i>xiii</i>	8.2 Inverse Function	Define inverse functions and demonstrate their domain and range with examples.	U	1
	<i>xiv</i>	9.3 Feasible Region	(iii) Identify the feasible region of simple LP problems.	U	1
	<i>xv</i>	10.2 Trigonometric Ratios of Allied Angles	(ii) Use fundamental law and its deductions to derive trigonometric ratios of allied angles.	U	1
	<i>xvi</i>	10.4 Sum, Difference and Product of sine and cosine	(i) Express the product (of sines and cosines) as sums or differences (of sines and cosines).	U	1
	<i>xvii</i>	10.3 Double, Half and Triple Angle Identities	Derive double angle, half angle and triple angle identities from fundamental law and its deductions.	K	1
	<i>xviii</i>	11.1 Solving Triangles	(iii) Apply law of sines, law of cosines and law of tangents to solve oblique triangles.	A	1
	<i>xix</i>	12.1 Period of Trigonometric Functions	(iii) Discuss the periodicity of trigonometric functions.	K	1

	<i>xx</i>	12.1 Period of Trigonometric Functions	(iv) Find the maximum and minimum value of a given function of the type: <ul style="list-style-type: none"> • $a + b\sin\theta$, • $a + b\cos\theta$, • $a + b\sin(c\theta + d)$, • $a + b\cos(c\theta + d)$, • the reciprocals of above, where a, b, c and d are real numbers. 	U	1
Sec-B	Q2	Contents and Scope	Student Learning Outcomes *	Cognitive Level **	Allocated Marks
	<i>i</i>	1.3 Solution of equations	(i) Solve the simultaneous linear equations with complex coefficients.	U	4
	<i>ii</i>	2.5 Row and Column operations	(v) Use row operations to find the inverse and rank of a matrix.	U	4
	<i>iii</i>	3.5 Dot or Scalar Product 3.6 Cross or Vector Product	(viii) Use dot product to find the angle between two vectors. (viii) Use cross product to find the angle between two vectors.	K	4
	<i>iii</i>	3.6 Cross or Vector Product	(iv) Prove that the magnitude of $A \times B$ represents the area of a parallelogram with adjacent sides A and B .	K	4
	<i>iv</i>	4.9 Harmonic Mean 4.6 Geometric Mean	(i) Define a harmonic mean. (i) Know geometric mean between two numbers.	K	4
	<i>iv</i>	5.2 Arithmetico-Geometric Series	(ii) Find sum to n terms of the arithmetico-geometric series.	K	4
	<i>v</i>	6.2 Permutation	(iv) Apply P_r^n to solve relevant problems of finding the number of arrangements of n objects taken r at a time (when all n objects are different and when some of them are alike).	K	4
	<i>v</i>	6.4 Probability	(ii) Recognize the formula for probability of occurrence of an event E , i.e. $P(E) = \frac{n(E)}{n(S)}, \quad 0 \leq P(E) \leq 1$	K	4
	<i>vi</i>	7.1 Mathematical Induction	(ii) Apply the principle to prove the statements, identities or formulae.	U	4
	<i>vi</i>	7.2 Binomial Theorem	(iv) Find the specified term in the expansion of $(x + y)^n$.	U	4
	<i>vii</i>	8.3 Graphical Representation of Functions	(v) Predict functions from their graphs (use the factor form to predict the equation of a function of the type $f(x) = ax^2 + bx + c$, if two points where the graph crosses x -axis and third point on the curve, are given).	A	4
	<i>viii</i>	9.3 Feasible Region	(ii) Define and show graphically the feasible region (or solution space) of an LP problem.	U	4
	<i>ix</i>	10.4 Sum, Difference and Product of sine and cosine	(ii) Express the sums or differences (of sines and cosines) as products (of sines and cosines).	U	4
	<i>x</i>	11.1 Solving Triangles	(ii) Define an oblique triangle and prove <ul style="list-style-type: none"> • the law of cosines, • the law of sines, • the law of tangents, and deduce respective half angle formulae. (iii) Apply above laws to solve oblique triangles.	U	4
	<i>xi</i>	11.3 Circles Connected with Triangles	(ii) Derive the formulae to find <ul style="list-style-type: none"> • circum-radius, • in-radius, • escribed-radii, and apply them to deduce different identities.	K	4
	<i>xii</i>	12.4 Inverse Trigonometric Functions	(v) Apply addition and subtraction formulae of inverse trigonometric functions to verify related identities.	A	4
	<i>xii</i>	12.5 Solving General Trigonometric Equations	(i) Solve trigonometric equations and check their roots by substitution in the	A	4

Sec-C	Q	Contents and Scope	Student Learning Outcomes *	Cognitive Level **	Allocated Marks
			given trigonometric equations so as to discard extraneous roots.		
	3	2.6 Solving System of Linear Equations	(iv) Solve a system of 3 by 3 non-homogeneous linear equations using Gauss-Jordan method (reduced echelon form).	K	8
	4	4.2 Arithmetic Sequence 4.5 Geometric Sequence	(iii) Solve problems involving arithmetic sequence. (iii) Solve problems involving geometric sequence.	U	8
	5	7.3 Binomial Series	(iii) Determine the approximate values of the binomial expansions having indices as -ve integers or fractions.	U	8
	5	9.4 Optimal Solution	(ii) Find optimal solution (graphical) through the following systematic procedure: Establish the mathematical formulation of LP problem, construct the graph, identify the feasible region, locate the solution points, evaluate the objective function, select the optimal solution and verify the optimal solution by actually substituting values of variables from the feasible region.	U	8
	6	10.4 Sum, Difference and Product of sine and cosine	(ii) Express the sums or differences (of sines and cosines) as products (of sines and cosines).	A	8
	6	12.3 Solving Trigonometric Equations Graphically	(ii) Solve graphically the trigonometric equations of the type <ul style="list-style-type: none"> • $\sin \theta = \frac{\theta}{2}$ • $\cos \theta = \theta$ • $\tan \theta = 2\theta$ when $-\frac{\pi}{2} \leq \theta \leq \frac{\pi}{2}$ 	A	8

* **Student Learning Outcomes**

National Curriculum for Mathematics Grades IX-XII, 2006

****Cognitive Level** K: Knowledge U: Understanding A: Application

ASSESSMENT GRID FOR MATHEMATICS HSSC-I

Subject: Mathematics

Examination:

Class/Level: HSSC-I

Year:

Code:

Topics	1. Complex Numbers	2. Matrices and Determinants	3. Vectors	4. Sequences and Series	5. Miscellaneous Series	6. Permutation, Combination and Probability	7. Mathematical Inductions and Binomial Theorem	8. Functions and Graphs	9. Linear Programming	10. Trigonometric Identities of Sum and Difference of Angles	11. Application of Trigonometry	12. Graphs of Trigonometric and Inverse Trigonometric Functions and Solution of Trigonometric Equations	Total marks for each assessment objective
Knowledge based	2i(4)	1iii(1) 1iv(1) 2iii(4) 3(4)	1v(1) 1vi(1) 2iv(4)	4(4)	1ix(1)		5(4)		6(4)		1xvii(1) 1xviii(1) 2xiii(4) 2xiv(4)	1xx(1) 2xv(4) 8(4)	52 (39.4%)
Comprehension based	1i(1) 1ii(1) 2ii(4)			2v(4) 1vii(1) 1viii(1) 4(4)	2vi(4)	2viii(4)	2ix(4)	1xiii(1)	1xiv(1) 6(4)	2xii(4) 1xvi(1) 7(4)		1xix(1) 2xvi(4) 8(4)	52 (39.4%)
Application based		3(4)				1x(1) 1xi(1) 2vii(4)	1xii(1) 5(4)	2x(4)	2xi(4)	1xv(1) 7(4)			28 (21.2%)
Total marks of each unit	10	14	06	14	05	10	13	05	13	14	10	18	132
Marks %age	7%	11%	5%	10%	4%	8%	9%	4%	10%	11%	8%	13%	100%

of each unit													
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- **1, 2, 3 etc. stands for question numbers**
- **i, ii, iii etc. stands for part of question numbers**
- **(1), (2), (3) etc. stands for marks of question papers**

FBISE PAST PAPERS