Federal Board HSSC-I Examination
Model Question Paper Mathematics
(Curriculum 2022-23)

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.*

ROLL NUMBER

0	0	0	0	0	0
1	1	1	1	1	1
2	2	2	2	2	2
3	3	3	3	3	3
4	4	4	4	4	4
5	5	5	5	5	5
6	6	6	6	6	6
7	7	7	7	7	7
8	8	8	8	8	8
9	9	9	9	9	9

Version No.

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
7	7	7	7
8	8	8	8
9	9	9	9

Candidate Sign.________ **Invigilator Sign.** ____________

Q1. Fill the relevant bubble against each question. Each part carries one mark.

Sr no.	Question	A	B	C	D	A	B	C	D
i.	If $z = x + iy$ then what is the real solution of $(x-3) \le 2$?	$x \le 5$	$y \le 2$	$x \le -5$	$y \le -2$	▯	▯	▯	▯
ii.	If $Z = \sqrt{3} - i$ then principal argument of z is written	$-\frac{\pi}{6}$	$\frac{\pi}{6}$	$-\frac{\pi}{3}$	$\frac{\pi}{3}$	▯	▯	▯	▯
iii.	For a square matrix A of order 3×3, $\lvert A \rvert = 9$, $A_{21} = 3, A_{22} = 3$, $A_{23} = -1$, $a_{21} = 1$, $a_{23} = 2$, what is the value of a_{22}?	2	3	9	−1	▯	▯	▯	▯
iv.	For a unique solution of system rank of matrix A must be equal to:	A_b	A^t	$\lvert A^b \rvert$	$\lvert A^t \rvert$	▯	▯	▯	▯
v.	What is the A.M of 20 terms of an A.P with first term 2 and common difference 2?	20	21	22	42	▯	▯	▯	▯
vi.	What is the value of H. M between two non-zero real numbers, if their $A.M = \frac{3\sqrt{2}}{2}$ and $G.M = 2$?	$\frac{8}{3\sqrt{2}}$	$\frac{4}{3\sqrt{2}}$	$\frac{3\sqrt{2}}{8}$	$\frac{3\sqrt{2}}{4}$	▯	▯	▯	▯
vii.	What is the 8th term of $(2x - \frac{1}{2x})^{12}$?	$198x^{-2}$	$198x^{2}$	$-198x^{-2}$	$-198x^{2}$	▯	▯	▯	▯

viii.	If (n): $2^n < n!$ then what is the smallest possible integer for which $S(n)$ is true:	1	2	3	4	▯ ▯ ▯ ▯
ix.	$\frac{x^2+3x-16}{x+4} = x - 4 - \frac{?}{x+4}$	3	-3	$3x$	$-3x$	▯ ▯ ▯ ▯
x.	If length of one side of the box having volume $x^3 - 2x^2 - x + 2$ is $(x-2)$, then the remaining two sides are:	$(x-1)^2$	$(x+1)^2$	$x^2 - 1$	$x^2 + 1$	▯ ▯ ▯ ▯
xi.	If the dot product of vector $\underline{a} = \underline{i} - 2\underline{j} + 3\underline{k}$ and $\underline{b} = \alpha\,\underline{i} - \underline{j} + 2\underline{k}$ is 10 then value of α is:	0	1	2	3	▯ ▯ ▯ ▯
xii.	If $\underline{a} = \underline{i} - 2\underline{j}$ and $\underline{b} = 2\underline{j} + \underline{k}$, then $\underline{a} \times \underline{b}$ is:	$-2\underline{i} - \underline{j} - 2\underline{k}$	$-2\underline{i} + \underline{j} - 2\underline{k}$	$2\underline{i} - \underline{j} + 2\underline{k}$	$-2\underline{i} - \underline{j} + 2\underline{k}$	▯ ▯ ▯ ▯
xiii.	Which of the vector pairs is orthogonal?	$\underline{i} + 2\underline{j} - \underline{k}$ and $\underline{i} + \underline{j} + \underline{k}$	$\underline{i} - 2\underline{j} - \underline{k}$ and $\underline{i} + \underline{j} - \underline{k}$	$-\underline{i} + 2\underline{j} + \mathrm{k}$ and $\underline{i} + \underline{j} + \underline{k}$	$-\underline{i} + 2\underline{j} - \underline{k}$ and $-\underline{i} + \underline{j} + \underline{k}$	▯ ▯ ▯ ▯
xiv.	If $cos\alpha = \frac{12}{13}$; $0 < \alpha < \frac{\pi}{2}$ and $sin\beta = \frac{5}{13}$; $\frac{\pi}{2} < \beta < \pi$ then value of $\cos(\alpha + \beta)$ is:	1	-1	$\frac{144}{169}$	$-\frac{144}{169}$	▯ ▯ ▯ ▯
xv.	If the expression $4sin5\alpha.cos3\alpha.cos2\alpha$ is expressed as sum of three sines, then two of them are $sin4\alpha$ and $sin10\alpha$. The third one is:	sin8α	sin6α	sin5α	sin12α	▯ ▯ ▯ ▯
xvi.	Which of the given functions is odd?	$f(x) = x + cos\ x$	$f(x) = x - cos\ x$	$f(x) = x^2 + cos\ x$	$f(x) = x + \sin x$	▯ ▯ ▯ ▯
xvii.	The period of a trigonometric function $3\ sin\ 3x$ is:	$\frac{\pi}{3}$	$\frac{2\pi}{3}$	$\frac{\pi}{2}$	$\frac{3\pi}{2}$	▯ ▯ ▯ ▯
xviii.	The minimum value of $3 + 4\ sin\ \theta$ is:	-1	0	1	7	▯ ▯ ▯ ▯
xix.	How many four-digit numbers divisible by 10 can be formed using digits 3, 5, 0, 8, 7 without repeating?	12	24	48	60	▯ ▯ ▯ ▯
xx.	If DNA sequence of length 8 is constructed using 4 nucleotides (A, C, G, T) with repetition allowed, how many possible sequences can be formed?	4^8	8^4	$\frac{8!}{4!\,4!}$	$4! \times 8$	▯ ▯ ▯ ▯

Federal Board HSSC-I Examination
Model Question Paper Mathematics

(Curriculum 2022-23)

Time allowed: 2.35 hours Total Marks: 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)

$(12 \times 4 = 48)$

Q.2	Question	Marks		Question	Marks
i.	If $z = x + iy$ then simplify the equation $\lvert z - 2i \rvert = \lvert \bar{z} + 3 \rvert$	4	***OR***	If the angle between two vectors $\underline{a} = 2\underline{i} - 3\underline{j} + 4\underline{k}$ and $\underline{b} = \underline{i} + 2\underline{j} + 2\underline{k}$ is θ, then find the values of $cos\ \theta$ and $sin\ \theta$.	4
ii.	Prove that $cos\left(\frac{\pi}{3} + x\right) - sin\left(\frac{\pi}{6} - x\right) = 0$	4	***OR***	Prove that $\binom{n-1}{r} + \binom{n-1}{r-1} = \binom{n}{r}$	4
iii.	Find volume of the tetrahedron if $a = 2\underline{i} - 3\underline{j} + \underline{k}$, $b = \underline{i} + 2\underline{j} - \underline{k}$ and $c = -3\underline{i} - \underline{j} + 5\underline{k}$ are its coterminous edges.	4	***OR***	Find the maximum and minimum values of the function $y = \dfrac{1}{5 + 6\ sin\ (2x + 3)}$	4
iv.	If $h(x) = 7x^4 - 10x^3 + 3x^2 + 3x - 3$ and one zero of $h(x)$ is 1, then find remaining zeros.	4	***OR***	In H.P if $a_3 = \frac{1}{11}$ and $a_{16} = \frac{1}{63}$, then find values of a_1, d and a_{20}	4
v.	Without drawing graph, find amplitude, period and frequency of the function $y = 3\ sin\ (5x + 2)$	4	***OR***	A force $\vec{F} = 3\underline{i} - 2\underline{j} + 5\underline{k}$ acts on a particle at point $P\ (3, -4, 2)$. Find moment of the force about origin and a point $(1, -1, -1)$.	4
vi.	In an arithmetic progression, sum of the first ten terms is 200 and the sum up to twenty terms is 1000. Find common difference and the first term.	4	***OR***	If $A, B,$ and C are the angle measures of a triangle such that $A + B + C = \pi$, then prove that $tanA + tanB + tanC = tanA\ tanB\ tanC$	4
vii.	Without expansion show that: $\begin{vmatrix} x & -z & 0 \\ 0 & y & -x \\ -y & 0 & z \end{vmatrix} = 0$	4	***OR***	Prove that $\dfrac{sin5x - sin3x}{cos5x + 2cos4x + cos3x} = \tan\dfrac{x}{2}$	4
viii.	A carpenter made a set of 50 wooden structures of Minar-e-Pakistan in different sizes. The height of the largest structure in the set was 70 cm. The heights of successive smaller structures were 95% of the preceding larger structure.	4	***OR***	Draw the graph of $y = 2\ cos\ x\ ;\ -\pi \le x \le \pi$	4

	(a) Find the height of the smallest structure in the set. (b) Find the total height if all 50 structures were placed one on top of another.				
ix.	Find the last two digits of a number $(23)^{14}$	4	***OR***	Find rank of the matrix: $\begin{bmatrix} 2 & 5 & 7 \\ 1 & 2 & -1 \\ -3 & -6 & 3 \end{bmatrix}$	4
x.	If $z = x + iy$ and $arg\left(\frac{z-1}{z+1}\right) = \frac{\pi}{2}$, then show that $x^2 + y^2 = 1$	4	***OR***	Find the value of r, if $P^{56}_{r+6} : P^{54}_{r+3} = 30800 : 1$	4
xi.	Use Binomial Theorem to find the remainder when 5^{99} is divided by 13.	4	***OR***	Find roots of the cubic polynomial $P(x) = 3x^3 - 5x^2 - 11x - 3$	4
xii.	If $A = \begin{bmatrix} x & 0 \\ y & 1 \end{bmatrix}$, then show that $A^n = \begin{bmatrix} x^n & 0 \\ \frac{y(x^n-1)}{(x-1)} & 1 \end{bmatrix}, n\epsilon z^+$	4	***OR***	Apply the principle of Mathematical Induction to prove that $7^{2n} + 7$ is divisible by 8 for all positive integral values of n.	4

SECTION – C (Marks 32)

$(4 \times 8 = 32)$

Note: Attempt all questions. Marks of each question are given.

Q. No.	Question	Marks		Question	Marks
Q3	(a) Factorize $x^3 - x^2 + 4x - 12$ (b) Solve $x^3 - x^2 + 4x - 12 = 0$ and identify real and complex roots.	8	***OR***	If $\underline{a} = 2\underline{i} - \underline{j} + 3\underline{k}$, $\underline{b} = 3\underline{i} + 2\underline{j} + 4\underline{k}$ and $\underline{c} = \underline{i} + 3\underline{j} - 5\underline{k}$, then verify that $\underline{a} \cdot \underline{b} \times \underline{c} = \underline{b} \cdot \underline{c} \times \underline{a} = \underline{c} \cdot \underline{a} \times \underline{b}$.	8
Q4	If x is very small such that its square and higher powers can be neglected, then show that $\frac{(8+3x)^{\frac{2}{3}}}{(2+3x)\sqrt{4-5x}} \approx 1 - \frac{5x}{8}$	8	***OR***	Prove the fundamental law of trigonometry $\cos(\alpha - \beta) = \cos\alpha\cos\beta + \sin\alpha\sin\beta$ where α and β be any two real angles.	8
Q5	Solve the following system of non-homogeneous linear equations by Gaussian Elimination Method: $2x - 3y + 5z = 2,$ $x + 4y - 2z = 1,$ $4x + 5y + z = 4$	8	***OR***	A Ferris wheel with a radius of 25 meters completes one full revolution in 4 minutes. Calculate the frequency of the Ferris wheel's rotation, the speed of a passenger at the edge of the wheel, and the time it takes for the passenger to travel from the bottom to the top of the wheel.	8
Q6	Find sum of the series $(a) \sum_{i=1}^{n} \frac{i}{7^i}$ and $(b) \sum_{i=1}^{\infty} \frac{i}{7^i}$	8	***OR***	Find the number of ways to select 3 balls from a collection of 4 orange, 5 red, and 6 green balls, such that: (a) All balls are of different colors. (b) All balls are of the same color. (c) No ball is red. (d) Exactly one ball is green.	8