

RUBRICS: HSSC 1st ANNUAL EXAMINATION 2023
SUBJECT: MATHEMATICS HSSC-I (Hard Area)

Q.# /Part #	Criteria	Level 1 (Marks)	Level 2(Marks)	Level 3 (Marks)	Level 4 (Marks)	Level 5 (Marks)	Level 6 (Marks)
2(i)	Showing that $\left Z_1 + \frac{1}{z_2}\right \approx 5$.	Correctly expressing $\frac{1}{z_2}$ in $a + ib$ form. (2)	Partially correct (1)	Wrong answer (0)			
		Correctly finding the value of $Z_1 + \frac{1}{z_2}$ AND $\left Z_1 + \frac{1}{z_2}\right $. (2)	Correctly finding the value of $Z_1 + \frac{1}{z_2}$ OR $\left Z_1 + \frac{1}{z_2}\right $. (1)	Partially correct (0.5)	Wrong answer (0)		
2(ii)	Constructing truth table of $(\sim p \rightarrow \sim q) \wedge p$.	Correctly declaring the propositions $p, \sim p$ AND $q, \sim q$. (2)	Correctly declaring the propositions $p, \sim p$ OR $q, \sim q$. (1)	Partially correct (0.5)	Wrong answer (0)		
		Correctly declaring the conditionals $\sim p \rightarrow \sim q$ AND $(\sim p \rightarrow \sim q) \wedge p$. (2)	Correctly declaring the conditionals $\sim p \rightarrow \sim q$ OR $(\sim p \rightarrow \sim q) \wedge p$. (1)	Partially correct (0.5)	Wrong answer (0)		
2(iii)	Showing that $\begin{vmatrix} y+z & x & y \\ z+x & z & x \\ x+y & y & z \end{vmatrix} = (x+y+z)(z-x)^2$.	Correctly applying the Row/Column operation AND correctly taking $(x+y+z)$ common. (2)	Correctly applying the Row/Column operation OR correctly taking $(x+y+z)$ common. (1)	Partially correct (0.5)	Wrong answer (0)		
		Correctly applying the Row/Column operation AND correctly simplifying for RHS. (2)	Correctly applying the Row/Column operation OR correctly simplifying for RHS. (1)	Partially correct (0.5)	Wrong answer (0)		

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2(iv)	Finding a quadratic equation whose roots are given.	Correctly applying the factor theorem AND correctly finding the value of p . (2)	Correctly applying the factor theorem OR correctly finding the value of p . (1)	Partially correct (0.5)	Wrong answer (0)		
		Correctly setting $Disc. = 0$ AND correctly finding the value of k . (2)	Correctly setting $Disc. = 0$ OR correctly finding the value of k . (1)	Partially correct (0.5)	Wrong answer (0)		
2(v)	Showing that $(x + y)^2 + (x\omega + y\omega^2)^2 + (x\omega^2 + y\omega)^2 = 6xy$.	Correctly expanding the squares AND correctly simplifying. (2)	Correctly expanding the squares OR correctly simplifying. (1)	Partially correct (0.5)	Wrong answer (0)		
		Correctly applying the properties of cube roots of unity AND simplifying for RHS. (2)	Correctly applying the properties of cube roots of unity OR simplifying for RHS. (1)	Partially correct (0.5)	Wrong answer (0)		
2(vi)	Resolving the given expression into partial fractions	Correctly stating the identity (1)	Incorrectly stating the identity (0)				
		Correctly finding the three unknown coefficients. (3)	Any two correct aspects. (2)	Any one correct aspect. (1)	Wrong answer (0)		
2(vii)	Finding required term from the given A.P.	Correctly finding the values of a_1, d, a_n AND correctly stating n th term of A.P. (2)	Correctly finding the values of a_1, d, a_n AND stating incorrect n th term of A.P. (1)	Partially correct (0.5)	Wrong answer (0)		
		Correctly finding the required term. (2)	Partially correct (1)	Wrong answer (0)			

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2 (viii)	Showing that $S_n = n(n+2)(2n+1)$	Correctly stating the values of $\sum k^2$, $\sum k$ and $\sum 1$. (2)	Any two correct aspects (1.5)	Any one correct aspect (1)	Wrong Answer (0)		
		Correctly simplifying for RHS. (2)	Partially correct (1)	Wrong answer (0)			
2(ix)	Proving that Tangent is a periodic function, and its period is π .	Correctly proving that Tangent is a periodic function. (2)	Partially correct (1)	Wrong answer (0)			
		Correctly proving that the period of Tangent is π . (2)	Partially correct (1)	Wrong answer (0)			
2(x)	Finding the probability of getting 6 and getting no 6.	Correctly finding the probability of getting 6 one time AND correctly finding the probability of getting 6 three times. (2)	Correctly finding the probability of getting 6 one time OR correctly finding the probability of getting 6 three times. (1)	Partially correct (0.5)	Wrong answer (0)		
		Correctly finding the probability of getting no 6 one time AND correctly finding the probability of getting no 6 three times. (2)	Correctly finding the probability of getting no 6 one time OR correctly finding the probability of getting no 6 three times. (1)	Partially correct (0.5)	Wrong answer (0)		
2(xi)	Finding the value of k .	Correctly finding the general term. (2)	Partially correct (1)	Wrong answer (0)			
		Correctly finding the values of r AND k . (2)	Correctly finding the values of r OR k . (1)	Partially correct (0.5)	Wrong answer (0)		

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2(xii)	Finding values of remaining trigonometric ratios.	Correctly identifying the quadrant. (1)	Wrong answer (0)				
		Correctly finding the remaining five trigonometric ratios. (3)	Any four correct aspects (2.5)	Any three correct aspects (2)	Any two correct aspects (1.5)	Any one correct aspect (1)	Wrong answer (0)
2(xiii)	Finding the value of $\cos(\alpha - \beta)$.	Correctly finding the values of $\cos \alpha$ AND $\sin \beta$. (2)	Correctly finding the values of $\cos \alpha$ OR $\sin \beta$. (1)	Partially correct (0.5)	Wrong answer (0)		
		Correctly stating the formula AND correctly finding the value of $\cos(\alpha - \beta)$. (2)	Correctly stating the formula OR correctly finding the value of $\cos(\alpha - \beta)$. (1)	Partially correct (0.5)	Wrong answer (0)		
2(xiv)	Proving that $(r_2 + r_3) \tan \frac{\alpha}{2} = a$.	Correctly writing the values of r_2, r_3 , and $\tan \frac{\alpha}{2}$. (2)	Any two correct aspects (1.5)	Any one correct aspect (1)	Wrong answer (0)		
		Correctly simplifying for RHS. (2)	Partially correct (1)	Wrong answer (0)			
2(xv)	Showing that $2 \tan^{-1} \left(\frac{1}{3} \right) + \tan^{-1} \left(\frac{1}{7} \right) = \frac{\pi}{4}$	Correctly converting $2 \tan^{-1} \left(\frac{1}{3} \right)$ to $\tan^{-1} \left(\frac{3}{4} \right)$ (2)	Partially correct (1)	Wrong answer (0)			
		Correctly converting $\tan^{-1} \left(\frac{3}{4} \right) + \tan^{-1} \left(\frac{1}{7} \right)$ to $\frac{\pi}{4}$. (2)	Partially correct (1)	Wrong answer (0)			
2(xvi)	Solving the given trigonometric equation.	Correctly applying the double angle identity AND correctly factorizing. (2)	Correctly applying the double angle identity OR correctly factorizing. (1)	Partially correct (0.5)	Wrong answer (0)		
		Correctly finding the solution set. (2)	Partially correct (1)	Wrong answer (0)			

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3.	Solving system of linear equations by Cramer's Rule.	Correctly writing the system of equations in matrix form AND correctly finding the determinant of the coefficient matrix. (2)	Correctly writing the system of equations in matrix form OR correctly finding the determinant of the coefficient matrix. (1)	Partially correct (0.5)	Wrong answer (0)		
		Correctly finding the values of $ A_x $, $ A_y $, and $ A_z $. (3)	Any two correct aspects (2)	Any one correct aspect (1)	Partially correct (0.5)	Wrong answer (0)	
		Correctly finding the values of x , y , and z . (3)	Any two correct aspects (2)	Any one correct aspect (1)	Partially correct (0.5)	Wrong answer (0)	
4.	Finding three consecutive numbers in G.P.	Correctly stating G.P. AND A.P. of the required numbers. (2)	Correctly stating G.P. OR A.P. of the required numbers. (1)	Partially correct (1)	Wrong answer (0)		
		Correctly finding the values of a AND r . (3)	Correctly finding the values of a OR r . (1.5)	Partially correct (1)	Wrong answer (0)		
		Correctly finding the three required numbers. (3)	Any two correct aspects (2)	Any one correct aspect (1)	Partially correct (0.5)	Wrong answer (0)	
5.	Proving that $y^2 + 2y - 7 = 0$ from the given series.	Correctly adding 1 to both sides of the equation AND correctly stating the binomial expansion. (2)	Correctly adding 1 to both sides of the equation OR correctly stating the binomial expansion. (1)	Partially correct (0.5)	Wrong answer (0)		
		Correctly finding values of x AND n . (3)	Correctly finding values of x OR n . (1.5)	Partially correct (1)	Wrong answer (0)		
		Correctly stating $(1 + x)^n = 1 + y$ AND correctly proving the required equation. (3)	Correctly stating $(1 + x)^n = 1 + y$ OR correctly proving the required equation. (1.5)	Partially correct (1)	Wrong answer (0)		

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6.	Proving that $\cos 40^\circ \cos 80^\circ \cos 120^\circ \cos 160^\circ = \frac{3}{16}$ Note: Awarding zero marks for using calculator.	Correctly writing the value of $\cos 120^\circ$ and correctly converting the cosine product into sum. (3)	Writing the incorrect value of $\cos 120^\circ$ and correctly converting the cosine product into sum. (2)	Correctly writing the value of $\cos 120^\circ$ and incorrect conversion of the cosine product into sum. (1)	Partially correct (0.5)	Wrong answer (0)	
		Correctly writing the value of $\cos 240^\circ$ and correctly converting the cosine product into sum. (3)	Writing the incorrect value of $\cos 240^\circ$ and correctly converting the cosine product into sum. (2)	Correctly writing the value of $\cos 240^\circ$ and incorrect conversion of the cosine product into sum. (1)	Partially correct (0.5)	Wrong answer (0)	
		Correctly writing the value of $\cos 120^\circ$ AND correctly proving for RHS. (2)	Correctly writing the value of $\cos 120^\circ$ OR correctly proving for RHS. (1)	Partially correct (0.5)	Wrong answer (0)		
7.	Solving the given system of equations.	Correctly factorizing the homogeneous equation AND correctly finding two linear equations. (4)	Correctly factorizing the homogeneous equation OR correctly finding two linear equations. (2)	Partially correct (1)	Wrong answer (0)		
		Correctly finding the solution set of four ordered pairs. (4)	Any three correct aspects (3)	Any two correct aspects (2)	Any one correct aspect (1)	Partially correct (0.5)	Wrong answer (0)

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8.	Solving ΔABC .	(a) Correctly stating the law of cosines. (1)	Partially correct (0.5)	Wrong answer (0)			
		Correctly finding the values of α , β , and γ . (3)	Any two correct aspects (2)	Any one correct aspect (1)	Partially correct (0.5)	Wrong answer (0)	
		(b) Correctly stating the law of cosines and law of sines. (1)	Partially correct (0.5)	Wrong answer (0)			
		Correctly finding the values of c , α , and β . (3)	Any two correct aspects (2)	Any one correct aspect (1)	Partially correct (0.5)	Wrong answer (0)	

Note: All the markers must know the solutions of all the question items of the question paper before starting marking.