School Education Depatment-Villupuram District
MARKING SCHEME – MATHEMATICS-ENGLISH MEDIUM

HIGHER SECONDARY – SECOND YEAR - QUARTERLY EXAM SEP 2024

GENERAL INSTRUCTIONS

Maximum Marks-90

1. The answers given in the marking scheme are Text Book and Solution Book bound.
2. If a student has given any answer which is different from one given in the marking scheme, but carries the prescribed content meaning (rigorous) such answer should be given full credit with suitable distribution.
3. Follow the foot notes which are given with certain answer – schemes.
4. If a particular stage is wrong and if the candidate writes the appropriate formula then award 1 mark for the formula (for the stage mark 2^{*}) .This mark is attached with that stage. This is done with the aim that a student who did the problem correctly without writing the formula should not be penalized. That is, mark should not be deducted for not writing the formula.

   * mark indicates these places in the scheme.
5. In the case of Part -II, Part II and Part IV, if the solution is correct then award full mark directly. The stage mark is essential only if the part of the solution is incorrect.
6. Answers written only in black or blue ink should be evaluated.

PART – I

1. 1 mark to write the correct option or the corresponding answer or both.
2. If one of them (option or answer) is wrong, then award ZERO mark only.

Question No.	Option	Answer
1	(d)	4
2	(c)	$\frac{\pi}{10}$
3	(a)	$\frac{\pi}{4}$
4	(b)	$2\sqrt{5}$
5	(a)	2ab
6	(b)	$(2, -4)$
7	(a)	1
8	(d)	$(5, -1, 1)$
9	(b)	$c = \pm\sqrt{3}$
10	(c)	2
11	(b)	8
12	(d)	$\begin{bmatrix} 5 & -2 \\ 3 & -1 \end{bmatrix}$
13	(d)	$\frac{\pi}{4}$
14	(b)	19
15	(a)	$\frac{3}{2} - 2i$
16	(b)	1
17	(a)	-2
18	(a)	mn
19	(b)	1
20	(b)	n

Important Note for Part-II, Part-III and Part-I

In an answer to a question, between any two particular stages of marks (greater than one) if a student starts from a stage with correct step but reaches the next stage with a wrong result then suitable credits should be given the related steps instead of denying the entire marks meant for the stage.

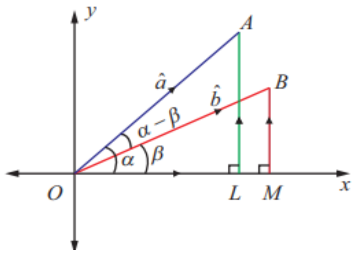
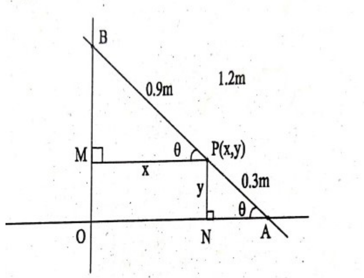
PART – II

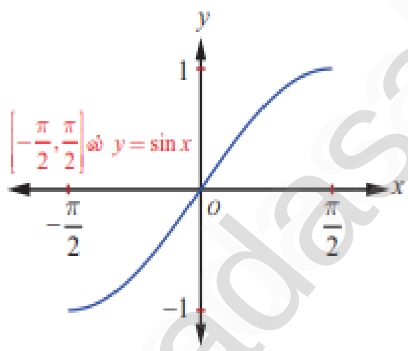
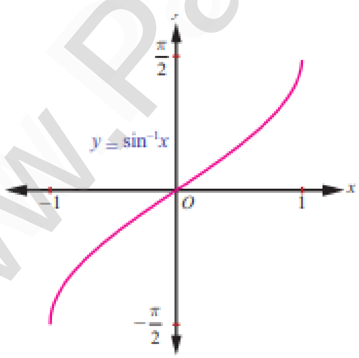
Q.No	Content	Marks
21.	$\begin{vmatrix} -1 & 3 \\ 4 & -7 \end{vmatrix} = -5 \neq 0$ $\rho(A) = 2$	1 1
22.	$z = (2+i\sqrt{3})^{10} + (2-i\sqrt{3})^{10}$ $\bar{z} = (2-i\sqrt{3})^{10} + (2+i\sqrt{3})^{10} = z \quad (or)\ \bar{z} = z$ z is real	 1 1
23.	Mod=2 $arg z = -\frac{5\pi}{6}$	1 1
24.	$2-\sqrt{3}i$ is also a root $x^2 - 4x + 7 = 0$	1 1
25.	Principal value= $\frac{2\pi}{3}$	2*
26.	$tan^{-1}\frac{1}{2} + tan^{-1}\frac{1}{3} = tan^{-1}(1)$ $tan^{-1}\frac{1}{2} + tan^{-1}\frac{1}{3} = \frac{\pi}{4}$	1 1
27.	Vertices: (0,-4) , (0,4) Foci : (0,-5) , (0,5)	1 1
28.	$(b_1, b_2, b_3) = (-3, 1, 1), (d_1, d_2, d_3) = (9, -3, -3),$ $\frac{b_1}{d_1} = \frac{b_2}{d_2} = \frac{b_3}{d_3} = -\frac{1}{3}$ Given points are collinear. (or) Any other Method	1 1
29.	Given planes $x + 2y - 2z + 1 = 0$ and $2x + 4y - 4z + 5 = 0.$ Distance= $\left\lvert \frac{1-\frac{5}{2}}{\sqrt{1+4+4}} \right\rvert = \frac{1}{2}$ (or) Any other Method	2*
30.	$A^T = \begin{bmatrix} \cos\theta & \sin\theta \\ -\sin\theta & \cos\theta \end{bmatrix}$ $A^{-1} = \begin{bmatrix} \cos\theta & \sin\theta \\ -\sin\theta & \cos\theta \end{bmatrix}$ $A^{-1} = A^T$	1 1

PART – III

Q.No	Content	Marks
31.	$(AB)^{-1} = \frac{1}{13}\begin{bmatrix}-11 & 5\\ -18 & 7\end{bmatrix}$ $A^{-1} = \begin{bmatrix}5 & -2\\ -7 & 3\end{bmatrix}$ (or) $B^{-1} = \frac{1}{13}\begin{bmatrix}2 & 3\\ -5 & -1\end{bmatrix}$ $B^{-1}A^{-1} = \frac{1}{13}\begin{bmatrix}-11 & 5\\ -18 & 7\end{bmatrix}$ $(AB)^{-1} = B^{-1}A^{-1}$	1 1 1
32.	$\lvert A\rvert = 4$ $A^{-1} = \frac{1}{4}\begin{bmatrix}2 & -2\\ -3 & 5\end{bmatrix}$ $x = -1, y = 4$	1 1 1
33.	$\left\lvert\frac{1}{z_1}+\frac{1}{z_2}+\frac{1}{z_3}\right\rvert = \lvert\overline{z_1}+\overline{z_2}+\overline{z_3}\rvert = \lvert\overline{z_1+z_2+z_3}\rvert$ $\lvert z_1+z_2+z_3\rvert = 1$	2 1
34.	$x^3 - 3x^2 - 33x + 35 = 0.$ $x = 1, 7, -5$	3
35.	$5 = 2\pi - (2\pi - 5)$ $\sin^{-1}[\sin 5] = \sin^{-1}[\sin(2\pi - (2\pi - 5))] = 5 - 2\pi \in \left[-\frac{\pi}{2}, \frac{\pi}{2}\right]$	1 2
36.	$sin^{-1}\left(\sin\frac{5\pi}{9}\cos\frac{\pi}{9} + \cos\frac{5\pi}{9}\sin\frac{\pi}{9}\right) = sin^{-1}\left(\sin(\frac{5\pi}{9}+\frac{\pi}{9})\right)$ $= sin^{-1}\left(\sin(\frac{2\pi}{3}\right) = sin^{-1}\left(\sin(\pi - \frac{\pi}{3})\right) = sin^{-1}\left(\sin(\frac{\pi}{3})\right) = \frac{\pi}{3} \in \left[-\frac{\pi}{2}, \frac{\pi}{2}\right]$	1 2*
37.	$p = 3, q = 3$ $x^2 + y^2 - 2x - 24 = 0$ Centre(1,0),radius=5	1 2
38.	$\frac{(ae)^2}{a^2} + \frac{{y_1}^2}{b^2} = 1$ ${y_1}^2 = b^2(1 - e^2)$ (or) $y_1 = \pm\frac{b^2}{a}$ Length of latus rectum $= \frac{2b^2}{a}$	1 1 1
39.	$\vec{a} = \hat{\imath} + \hat{\jmath} + \hat{k}, \vec{b} = \hat{\imath}, \vec{c} = \hat{\imath} + 2\hat{\jmath} + c_3\hat{k}.$ $\begin{vmatrix}1 & 1 & 1\\ 1 & 0 & 0\\ 1 & 2 & c_3\end{vmatrix} = 0$ $c_3 = 2$	1 2
40.	$[\vec{a}+\vec{b}, \vec{b}+\vec{c}, \vec{c}-\vec{a}] = [\vec{a}, \vec{b}, \vec{c}]\begin{vmatrix}1 & 1 & 0\\ 0 & 1 & 1\\ -1 & 0 & 1\end{vmatrix}$ $[\vec{a}+\vec{b}, \vec{b}+\vec{c}, \vec{c}-\vec{a}] = 2[\vec{a}, \vec{b}, \vec{c}]$ (or) Any other method	2 1

PART – III

Q.No	Content	Marks
41.a	Rough Diagram  $\hat{a} = cosA\hat{i} + sinA\hat{j}, \hat{b} = cosB\hat{i} + sinB\hat{j}$ $\hat{a}.\hat{b} = \text{Cos}(A - B)$ $\hat{a}.\hat{b} = \text{Cos}\,A\cos B + \text{Sin}\,A \sin B$ $\text{Cos}(A - B) = \text{Cos}\,A\cos B + \text{Sin}\,A\sin B$	1 1 1 1 1
	OR	
41.b	Rough diagram  $\Delta ANP \| \| \Delta PMB$ From $\Delta\, ANP$: $\cos\theta = \frac{x_1}{0.9}$; From $\Delta\, PMB$: $\sin\theta = \frac{y_1}{0.3}$ Locus of a equation $P(x_1, y_1)$, $\cos^2\theta + \sin^2\theta = 1$ $\frac{(x_1)^2}{(0.9)^2} + \frac{(y_1)^2}{(0.3)^2} = 1$ $\frac{x^2}{(0.9)^2} + \frac{y^2}{(0.3)^2} = 1$ The eccentricity $e = \sqrt{\frac{a^2 - b^2}{a^2}} = \sqrt{\frac{8}{9}} = \frac{2\sqrt{2}}{3}$ (or) Any other method	1 1+1 1 1
42.a	Line : $\frac{x-4}{1} = \frac{y-3}{2} = \frac{z-2}{3} = \lambda$ Point (λ+4,2λ+3,3λ+2) lies in the plane. $(\lambda + 4) + 2(2\lambda + 3) + 3(3\lambda + 2) = 2$, λ=-1 The coordinates of the foot of the perpendicular (3,1-1) Length of the perpendicular= $\sqrt{14}$ Note: One can do in a different method	1 2* 2*

	OR	
42.b	$a = \cos\alpha + i\sin\alpha,\quad b = \cos\beta + i\sin\beta,\quad c = \cos\gamma + i\sin\gamma$ $(\cos\alpha + i\sin\alpha)^3 + (\cos\beta + i\sin\beta)^3 + (\cos\gamma + i\sin\gamma)^3$ $= 3(\cos\alpha + i\sin\alpha)(\cos\beta + i\sin\beta)(\cos\gamma + i\sin\gamma)$ $\cos 3\alpha + i\sin 3\alpha + \cos\beta + i\sin 3\beta + \cos 3\gamma + i\sin 3\gamma$ $= 3[\cos\ (\alpha+\beta+\gamma) + i\sin(\alpha+\beta+\gamma)]$ $(\cos 3\alpha + \cos 3\beta + \cos 3\gamma) + i(\sin 3\alpha + \sin 3\beta + \sin 3\gamma) =$ $3[\cos\ (\alpha+\beta+\gamma) + i\sin(\alpha+\beta+\gamma)]$ **Equating Real and Imaginary parts** $(i)\ \cos 3\alpha + \cos 3\beta + \cos 3\gamma = 3\cos(\alpha+\beta+\gamma)$ $(ii)\ \sin 3\alpha + \sin 3\beta + \sin 3\gamma = 3\sin(\alpha+\beta+\gamma)$	1 2* 1 1
43.a	$\frac{(x-2)^2}{1} - \frac{(y+3)^2}{9} = 1$ **Centre:(2,-3)** **Eccentricity=$\sqrt{10}$** **Foci: (2+$\sqrt{10}$,-3) and : (2-$\sqrt{10}$,-3)**	2* 1 1 1
	OR	
43.b	 	2 3
44.a	$\left(x^2 + \frac{1}{x^2}\right) - 10\left(x + \frac{1}{x}\right) + 26 = 0$ $Put, y = x + \frac{1}{x}$ $y^2 - 10y + 24 = 0$ (or) $(y-6)(y-4) = 0$ (or) $y = 6, 4$ $x + \frac{1}{x} = 6 \Rightarrow x = 3 \pm 2\sqrt{2}$ $x + \frac{1}{x} = 4 \Rightarrow x = 2 \pm \sqrt{3}$ **Hence, the roots are** $3 + 2\sqrt{2}, 3 - 2\sqrt{2}, 2 + \sqrt{3}, 2 - \sqrt{3}$	1 1 1 1 1

	OR	
44.b	$cos\left(sin^{-1}\left(\frac{x}{\sqrt{1+x^2}}\right)\right)=\frac{1}{\sqrt{1+x^2}}$ $sin\left\{cot^{-1}\left(\frac{3}{4}\right)\right\}=\frac{4}{5}$ We know that $sin^{-1}\left(\frac{x}{\sqrt{1+x^2}}\right)=cos^{-1}\left(\frac{1}{\sqrt{1+x^2}}\right)$ $\frac{1}{\sqrt{1+x^2}}=\frac{4}{5}$ Thus $x=\pm\frac{3}{4}$	1 1 1 2
45.a	$\vec{a}=2\hat{\imath}+3\hat{\jmath}+6\hat{k},\vec{b}=2\hat{\imath}+3\hat{\jmath}+\hat{k},\vec{c}=2\hat{\imath}-5\hat{\jmath}-3\hat{k}$ The non-parametric vector equation: $\vec{r}.(\hat{\imath}-2\hat{\jmath}+4\hat{k})=20$ Cartesian equation: $\begin{vmatrix}x-2 & y-3 & z-6\\ 2 & 3 & 1\\ 2 & -5 & -3\end{vmatrix}=0$ $x-2y+4z=20$	1 2^* 2^*
	OR	
45.b	$[A\|B]=\left[\begin{array}{ccc\|c}4 & 3 & 6 & 25\\ 1 & 5 & 7 & 13\\ 2 & 9 & 1 & 1\end{array}\right]\sim\left[\begin{array}{ccc\|c}1 & 5 & 7 & 13\\ 4 & 3 & 6 & 25\\ 2 & 9 & 1 & 1\end{array}\right]$ $\sim\left[\begin{array}{ccc\|c}1 & 5 & 7 & 13\\ 0 & -17 & -22 & -27\\ 0 & -1 & -13 & -25\end{array}\right]\sim\left[\begin{array}{ccc\|c}1 & 5 & 7 & 13\\ 0 & 17 & 22 & 27\\ 0 & 1 & 13 & 25\end{array}\right]$ $\sim\left[\begin{array}{ccc\|c}1 & 5 & 7 & 13\\ 0 & 17 & 22 & 27\\ 0 & 0 & 199 & 398\end{array}\right]$ $x+5y+7z=13,\ 17y+22z=27, 199z=398.$ $x=4,y=-1,z=2$	2^* 1+1+1
46.a	$[A\|B]=\left[\begin{array}{ccc\|c}1 & 2 & 1 & 7\\ 1 & 1 & \lambda & \mu\\ 1 & 3 & -5 & 5\end{array}\right]$ $\sim\left[\begin{array}{ccc\|c}1 & 2 & 1 & 7\\ 1 & 3 & -5 & 5\\ 1 & 1 & \lambda & \mu\end{array}\right]\sim\left[\begin{array}{ccc\|c}1 & 2 & 1 & 7\\ 0 & 1 & -6 & -2\\ 1 & -1 & \lambda-1 & \mu-7\end{array}\right]$ $\sim\left[\begin{array}{ccc\|c}1 & 2 & 1 & 7\\ 0 & 1 & -6 & -2\\ 0 & 0 & \lambda-7 & \mu-9\end{array}\right]$ (i) When $\lambda=7$ and $\mu\neq 9$, It has no solution. (ii) When $\lambda\neq 7$ and $\mu\epsilon R$, It has a unique solution. (iii) When $\lambda=7$ and $\mu=9$, It has an infinite number of solutions.	2^* 1 1 1
	OR	

46.b	$z = x + iy$ $\frac{z-1}{z+1} = \frac{x+iy-1}{x+iy+1} = \frac{(x-1)+iy}{(x+1)+iy}$ $= \frac{(x-1)(x+1)+y^2+i[y(x+1)-y(x-1)]}{(x+1)^2+y^2}$ $\arg\left[\frac{z-1}{z+1}\right] = \frac{\pi}{2} \Rightarrow \tan^{-1}\left[\frac{y(x+1)-y(x-1)}{(x-1)(x+1)+y^2}\right] = \frac{\pi}{2}$ $\frac{xy+y-xy+y}{(x-1)(x+1)+y^2} = \tan\frac{\pi}{2}$ $\Rightarrow x^2+y^2 = 1$ (or) Any other method	1 1 1 1 1
47.a	Given roots are $2+i, 3-\sqrt{2}$ Other roots will be $2-i, 3+\sqrt{2}, \alpha, \beta$ $\Sigma_1 = \frac{\text{-co-effi of } x^5}{\text{co-effi of } x^6}$ $4+6+\alpha+\beta = 13$ $\alpha+\beta = 3 ------(1)$ $\Sigma_6 = \frac{\text{constant}}{\text{co-effi of } x^6}$ $(2+i)(2-i)(3-\sqrt{5})(3+\sqrt{2})\alpha\beta = -140$ $(4+1)(9-2)\alpha\beta = -140$ $(5)(7)\alpha\beta = -140$ $\alpha\beta = -4 ------(2)$ $x^2-3x-4 = 0\ (or) (x-4)(x+1) = 0$ $x = -1, 4$ The roots are $2+i, 2-i, 3-\sqrt{2}, 3+\sqrt{2}, -1, 4$. Note: One can do in a different method	1 1 1 1 1
	OR	
47.b	$d = a_2 - a_1 = a_3 - a_2 = \cdots = a_n - a_{n-1}$ L.H.S= $\tan\left[\tan^{-1}\left(\frac{a_2-a_1}{1+a_1a_2}\right) + \tan^{-1}\left(\frac{a_3-a_2}{1+a_2a_3}\right) + \cdots + \tan^{-1}\left(\frac{a_n-a_{n-1}}{1+a_na_{n-1}}\right)\right]$ $= \tan[\tan^{-1}(a_2) - \tan^{-1}(a_1) + \tan^{-1}(a_3) - \tan^{-1}(a_2) + \tan^{-1}(a_n) - \tan^{-1}(a_{n-1})]$ $= \tan[\tan^{-1}(a_n) - \tan^{-1}(a_1)] = \tan\left[\tan^{-1}\left(\frac{a_n-a_1}{1+a_1a_n}\right)\right]$ $= \left(\frac{a_n-a_1}{1+a_1a_n}\right) = R.H.S$ (or) Any other method	2* 1 1 1