

QUARTERLY EXAMINATION – SEPTEMBER – 2023			
Duration : 3 Hours	STANDARD - XII- MATHEMATICS	Marks: 90	A

Part- I**Note: Marks should be awarded for alternate method****Choose the correct answer: -****20 x 1 = 20**

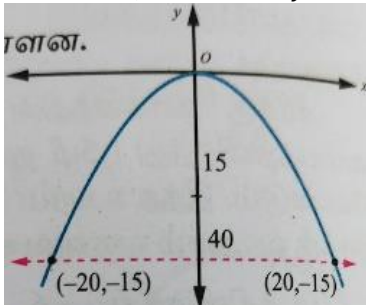
<u>Q.Number</u>	<u>Answer</u>	<u>Marks</u>
1	(2) 4	1
2	(2) $(A^T)^2$	1
3	(3) 19	1
4	(1) z	1
5	(3) $-3\pi/4$	1
6	(1) 0	1
7	(4) $ K \geq 6$	1
8	(3) n கலப்பெண்மூலங்கள்	1
9	(1) $-q/r$	1
10	(3) $\pi/2 - x$	1
11	(1) [1,2]	1
12	(2) $1/\sqrt{5}$	1
13	(4) 9	1
14	(2) (-3,2)	1
15	(1) 2ab	1
16	(4) அதிபரவளையம்	1
17	(3) π	1
18	(2) 1	1
19	(1) $2\sqrt{3}$	1
20	(4) $\cos^{-1}(4/5)$	1

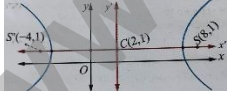
Part - II**Answer any seven questions:-****7 x 2 = 14**

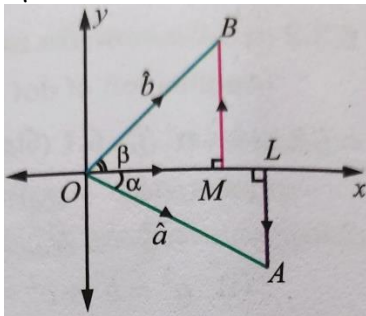
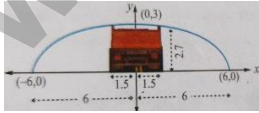
Question number 30 is compulsory

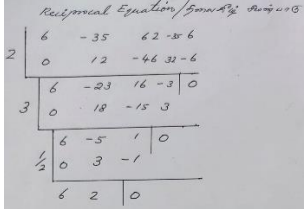
21	$ adj A = \begin{vmatrix} -1 & 2 & 2 \\ 1 & 1 & 2 \\ 2 & 2 & 1 \end{vmatrix} = 9$ $A^{-1} = \pm \frac{1}{\sqrt{ adj A }} adj A = \pm \frac{1}{3} \begin{pmatrix} -1 & 2 & 2 \\ 1 & 1 & 2 \\ 2 & 2 & 1 \end{pmatrix}$	1 1
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Q.Number	Answer	Marks
22	$\Delta = \begin{vmatrix} 5 & -2 \\ 1 & 3 \end{vmatrix} = 15 + 2 = 17$ $x = \frac{\Delta x}{\Delta} = -2, \quad y = \frac{\Delta y}{\Delta} = 3$	1 1
23	$\left z - \left(\frac{5}{3} - \frac{i}{3} \right) \right = 4/3$ $ z - z_0 = r$, என்ற வடிவில் உள்ளதால் இது ஒரு வட்டத்தைக் குறிக்கும் மையம் $\left(\frac{5}{3}, \frac{-1}{3} \right)$, ஆரம் $\frac{4}{3}$	1 1
24	பூஜ்ஜியமூலம் 1 மெய்யெண் மூலம் இல்லை கலப்பெண் மூலம் = 8	1 1 1
25	$\cos^{-1} \left(\frac{-1}{2} \right) = \pi - \cos^{-1} \left(\frac{1}{2} \right)$ $2\pi/3$	1 1
26	$m = 2\sqrt{2}$ $a^2 = 16$ $c = \pm 12$	1 1
27	$y^2 = 4ax$ $y^2 = 8x$	1 1
28	$[\bar{a} + \bar{b}, \bar{b} + \bar{c}, \bar{c} + \bar{a}] = \begin{vmatrix} 1 & 1 & 0 \\ 0 & 1 & 1 \\ 1 & 0 & 1 \end{vmatrix} [\bar{a}, \bar{b}, \bar{c}]$ $2[\bar{a}, \bar{b}, \bar{c}]$	1 1
29	$x + 2y - 2z + 5/2 = 0$ தொலைவு = $\frac{ d_1 - d_2 }{\sqrt{a^2 + b^2 + c^2}} = \frac{1}{2}$	1 1
30	$2 \sin^{-1} x > \frac{\pi}{2}$ தீர்வு set $(1/2, 1]$	1 1
31	$[A, B] = \begin{bmatrix} 2 & 2 & 1 & 5 \\ 1 & -1 & 1 & 1 \\ 3 & 1 & 2 & 4 \end{bmatrix}$ $\begin{bmatrix} 1 & -1 & 1 & 1 \\ 0 & 4 & -1 & 3 \\ 0 & 0 & 0 & -2 \end{bmatrix}$ $\rho(A) = 2, \quad \rho[A, B] = 3$ தொகுப்பு ஒருங்கமைவு அற்றது தீர்வு இல்லை	1 1 1
32	$ (2x - 3) + (2y - 1)i ^2 = 9$ $(2x - 3)^2 + (2y - 1)^2 = 9$ $4x^2 + 4y^2 - 12x - 4y + 1 = 0$, கார்ட்டீசியன் வடிவில் z-ன் நியமப்பாதை	1 1 1
33	$z = \sin \frac{\pi}{10} + i \cos \frac{\pi}{10}, \quad 1/z = \sin \frac{\pi}{10} - i \cos \frac{\pi}{10}$ $= \left(\frac{1+z}{1+1/z} \right)^{10} = z^{10}$	1 1

Q.Number	Answer	Marks
	$= i^{10} \left(\cos \frac{\pi}{10} - i \sin \frac{\pi}{10} \right)^{10} = 1$	1
34	$p + q = -\frac{n}{l}, pq = \frac{n}{l}$ $\sqrt{\frac{p}{q}} + \sqrt{\frac{q}{p}} = \frac{p+q}{\sqrt{pq}} = -\sqrt{n/l}$ $\sqrt{\frac{p}{q}} + \sqrt{\frac{q}{p}} + \sqrt{\frac{n}{l}} = 0$	1 1 1
35	$y^2 - 9y + 20 = 0$ $x^2 = 4$ and $x^2 = 5$ $x = \pm 2$ and $x = \pm\sqrt{5}$	1 1 1
36	$\sin^{-1} \left(\sin \frac{5\pi}{9} \cos \frac{\pi}{9} \cos \frac{5\pi}{9} \sin \frac{\pi}{9} \right) = \sin^{-1} \left(\sin \left(\frac{5\pi}{9} + \frac{\pi}{9} \right) \right)$ $\sin^{-1} \left(\sin \left(\pi - \frac{\pi}{3} \right) \right) = \sin^{-1} \left(\sin \frac{\pi}{3} \right)$ $= \frac{\pi}{3} \in \left[-\frac{\pi}{2}, \frac{\pi}{2} \right]$	1 1 1
37	$a^2 = 25, b^2 = 9, e = 4/5$ மையம்: (h,k) = (0,0) குவியங்கள்: $(\pm ae, 0) = (\pm 4, 0)$ முனைகள்: $(\pm a, 0) = (\pm 5, 0)$	1 1 1
38	i) துணை அலகு வெக்டார் சமன்பாடு $\vec{r} = \vec{a} + t\vec{b} \Rightarrow \vec{r} = (\vec{i} + 2\vec{j} - 3\vec{k}) + t(4\vec{i} + 5\vec{j} - 7\vec{k})$ ii) துணை அலகு அல்லாத வெக்டார் சமன்பாடு $(\vec{r} - \vec{a}) \times \vec{b} = 0$ $\Rightarrow (\vec{r} - (\vec{i} + 2\vec{j} - 3\vec{k})) \times (4\vec{i} + 5\vec{j} - 7\vec{k}) = 0$ iii) கார்ட்டீசியன் சமன்பாடு $\frac{x-1}{4} = \frac{y-2}{5} = \frac{z+3}{-7}$	1 1 1
39	$\vec{r} = \vec{a} + t\vec{b}$ $\vec{DF} = \vec{OF} - \vec{OD} = (2t + 2)\vec{i} + (3t - 6)\vec{j} + t\vec{k}$ $\vec{b} \cdot \vec{DF} = 0 \Rightarrow t = 1$ $\therefore F$ -ன் ஆய அச்சு தூரங்கள் (3, -1, 4)	1 1 1
40	பரவளையம் கீழ்ப்புறம் திறப்புடையது At (10,10) $4a=10$ \therefore சமன்பாடு $x^2 = -10y$ 	1 1 1

Q.Number	Answer	Marks
Part IV		
Note:	Answer all the questions	7 x 5 = 35
41 a)	$[A, B] = \begin{bmatrix} 1 & 1 & 3 & 0 \\ 4 & 3 & \lambda & 0 \\ 2 & 1 & 2 & 0 \end{bmatrix}$ $= \begin{bmatrix} 1 & 1 & 3 & 0 \\ 2 & 1 & 2 & 0 \\ 4 & 3 & \lambda & 0 \end{bmatrix} R_2 \leftrightarrow R_3$ $= \begin{bmatrix} 1 & 1 & 3 & 0 \\ 0 & -1 & -4 & 0 \\ 0 & -1 & \lambda - 12 & 0 \end{bmatrix} R_2 \rightarrow R_2 - 2, \quad R_3 \rightarrow R_3 - 4R_1$ $= \begin{bmatrix} 1 & 1 & 3 & 0 \\ 0 & -1 & -4 & 0 \\ 0 & 0 & \lambda - 8 & 0 \end{bmatrix} R_3 \rightarrow R_3 - R_2$ <p>$\lambda \neq 8$ வெளிப்படைத் தீர்வு $\lambda = 8$ வெளிப்படையற்ற தீர்வு</p>	1 1 1 1 1
41 b)	$\tan^{-1} \left[\frac{y-1}{x} \right] - \tan^{-1} \left[\frac{y}{x+2} \right] = \pi/4$ $\tan^{-1} \left[\frac{\frac{y-1}{x} - \frac{y}{x+2}}{1 + \left(\frac{y-1}{x}\right)\left(\frac{y}{x+2}\right)} \right] = \pi/4$ $\left[\frac{(x+2)(y-1) - xy}{x(x+2)} \right] = \tan \pi/4$ $\frac{(x+2)(y-1) - xy}{x(x+2) + y(y-1)} = 1$ $x^2 + y^2 + 3x - 3y + 2 = 0$	1 1 1 1 1
42 a)	$\frac{(x-2)^2}{25} - \frac{(y-1)^2}{11} = 1$ <p>$a^2=25, b^2=11, e=6/5$ மையம் (2,1) சுவியங்கள் (8,1) (-4,1) தோராய வரைபடம்</p> 	1 1 1 1 1
42b)	$\begin{bmatrix} 2 & 3 & -1 \\ 1 & 1 & 1 \\ 3 & -1 & -1 \end{bmatrix} \begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} 9 \\ 9 \\ -1 \end{bmatrix}$ $ A = 16$ $adj A = \begin{bmatrix} 0 & 4 & 4 \\ 4 & 1 & -3 \\ -4 & 11 & -1 \end{bmatrix}$ $A^{-1} = \frac{1}{16} \begin{bmatrix} 0 & 4 & 4 \\ 4 & 1 & -3 \\ -4 & 11 & -1 \end{bmatrix}$ $X = A^{-1}B \quad x=2, y=3, z=4$	1 1 1 1 1
43 a)	$z^3 = -8i$ $= 8^{\frac{1}{3}}(-1)^{\frac{1}{3}}z = 2 \left[\cos \left(\frac{-\pi + 4k\pi}{6} \right) + i \sin \left(\frac{-\pi + 4k\pi}{6} \right) \right]$	1

Q.Number	Answer	Marks
	$k=0$ எனில் $z = \sqrt{3} - i$ $k=1$ எனில் $z=2i$ $k=2$ எனில் $z = -\sqrt{3} - i$	2
43 b)	$\hat{a} = \cos \alpha \hat{i} - \sin \alpha \hat{j}$ $\hat{b} = \cos \beta \hat{i} + \sin \beta \hat{j}$ தோராய வரைபடம்  $\hat{a} \cdot \hat{b} = \cos \alpha \cos \beta - \sin \alpha \sin \beta$ $\hat{a} \cdot \hat{b} = \cos(\alpha + \beta)$ $\cos(\alpha + \beta) = \cos \alpha \cos \beta - \sin \alpha \sin \beta$	1
44 a)	$(x - 2)(x - 3)(x - 7)(x + 2) + 19 = 0$ $y^2 - 8y - 65 = 0$ $y=13, -5$ தீர்வு $\frac{5 \pm \sqrt{77}}{2}, \frac{5 \pm \sqrt{5}}{2}$	2 1 2
44 b)	$\vec{a} = 2\hat{i} + 3\hat{j} + 6\hat{k}$ $\vec{u} = 2\hat{i} + 3\hat{j} + \hat{k}$ $\vec{v} = 2\hat{i} - 5\hat{j} - 3\hat{k}$ $\vec{u} \times \vec{v} = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 2 & 3 & 1 \\ 2 & -5 & -3 \end{vmatrix} = -4\hat{i} + 8\hat{j} - 16\hat{k}$ $(\vec{r} - \vec{a}) \cdot (\vec{u} \times \vec{v}) = 0$ வெக்டர் சமன்பாடு $\vec{r} \cdot (\hat{i} - 2\hat{j} + 4\hat{k}) = 20$ கார்ட்டீசியன் சமன்பாடு $x - 2y + 4z = 20$	1 1 1 1
45 a)	$\tan^{-1} \left[\frac{x + y + z - xyz}{1 - xy - yz - zx} \right] = \pi$ $\frac{x + y + z - xyz}{1 - xy - yz - zx} = \tan \pi = 0$ $x + y + z = xyz$	3 1 1
45 b)	தோராய வரைபடம்  $\frac{x^2}{36} + \frac{y^2}{9} = 1$ $x=1.5$ $y=2.90$ இந்த வாகனம் வளைவின் வழிச் செல்லும்	1 1 1 1 1
46 a)	$y = -\frac{5}{12}x + \frac{3}{4}$ $m = -5/12 \quad c = 3/4$ $a^2 = 9 \quad b^2 = 1$	1 1 1

Q.Number	Answer	Marks
	LHS $3/4$ RHS $\sqrt{9\left(\frac{25}{144}\right)} - 1 = 3/4$ தொடர்புள்ளி $(5, -4/3)$	1 1
46 b)	 $x = 2, x = 3, x = 1/2, x = 1/3$	1 1 1 1 1
47 a)	$\sin \alpha = 1/\sqrt{5}$ $\cos \alpha = 2/\sqrt{5}$ $\cos \beta = 4/5$ $\sin \beta = 3/5$ $\sin(\alpha - \beta) = \sin \alpha \cos \beta - \cos \alpha \sin \beta$ $= \frac{1}{\sqrt{5}} \cdot \frac{4}{5} - \frac{2}{\sqrt{5}} \cdot \frac{3}{5}$ $= \frac{4-6}{5\sqrt{5}} = \frac{-2}{5\sqrt{5}} = \frac{-2\sqrt{5}}{25}$	1 1 1 1 1
47 b)	$\vec{a} \times \vec{b} = 11\hat{i} - 7\hat{j} + \hat{k}$ $(\vec{a} \times \vec{b}) \times \vec{c} = -19\hat{i} - 34\hat{j} - 29\hat{k}$ $(\vec{a} \cdot \vec{c})\vec{b} = -33\hat{i} - 55\hat{j} - 22\hat{k}$ $(\vec{b} \cdot \vec{c})\vec{a} = -14\hat{i} - 21\hat{j} + 7\hat{k}$ $(\vec{a} \cdot \vec{c})\vec{b} - (\vec{b} \cdot \vec{c})\vec{a} = -19\hat{i} - 34\hat{j} - 29\hat{k}$	1 1 1 1 1

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Duration : 3 Hours	STANDARD - XII- MATHEMATICS	Marks: 90	A
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Part – I

Note: Marks should be awarded for alternate method

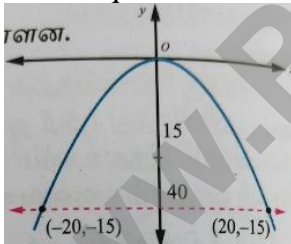
Choose the correct answer: -

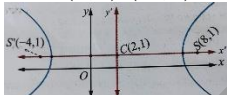
20 x 1 = 20

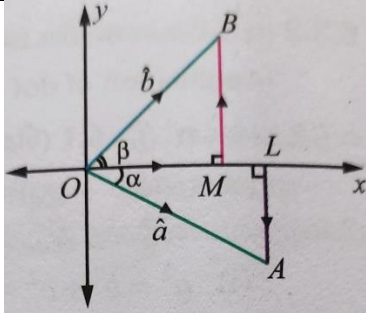
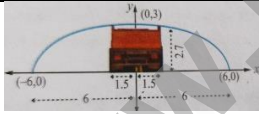
Q.Number	Answer	Marks
1	(2) 4	1
2	(2) $(A^T)^2$	1
3	(3) 19	1

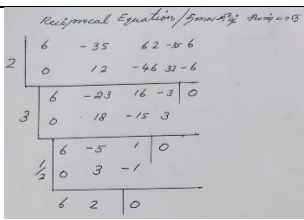
Q.Number	Answer	Marks
4	(1) z	1
5	(3) $-3\pi/4$	1
6	(1) 0	1
7	(4) $ K \geq 6$	1
8	(3) n complex roots,	1
9	(1) $-q/r$	1
10	(3) $\pi/2 - x$	1
11	(1) [1,2]	1
12	(2) $1/\sqrt{5}$	1
13	(4) 9	1
14	(2) (-3,2)	1
15	(1) 2ab	1
16	(4) Hyperbola	1
17	(3) π	1
18	(2) 1	1
19	(1) $2\sqrt{3}$	1
20	(4) $\cos^{-1}(4/5)$	1
Part - II		
Answer any seven questions:-		7 x 2 = 14
Question number 30 is compulsory		
21	$ adj A = \begin{vmatrix} -1 & 2 & 2 \\ 1 & 1 & 2 \\ 2 & 2 & 1 \end{vmatrix} = 9$ $A^{-1} = \pm \frac{1}{\sqrt{ adj A }} adj A = \pm \frac{1}{3} \begin{pmatrix} -1 & 2 & 2 \\ 1 & 1 & 2 \\ 2 & 2 & 1 \end{pmatrix}$	1 1
22	$\Delta = \begin{vmatrix} 5 & -2 \\ 1 & 3 \end{vmatrix} = 15 + 2 = 17$ $x = \frac{\Delta x}{\Delta} = -2, \quad y = \frac{\Delta y}{\Delta} = 3$	1 1
23	$\left z - \left(\frac{5}{3} - \frac{i}{3} \right) \right = 4/3$ <p>It is of the form $z - z_0 = r$, and so it represents a circle</p> <p>Centre $\left(\frac{5}{3}, \frac{-1}{3} \right)$, radius $\frac{4}{3}$</p>	1 1
24	zero root 1 No real root Complex (imaginary) roots= 8	1 1

Q.Number	Answer	Marks
25	$\cos^{-1}\left(\frac{-1}{2}\right) = \pi - \cos^{-1}\left(\frac{1}{2}\right)$ $2\pi/3$	1 1
26	$m = 2\sqrt{2}$ $a^2 = 16$ $c = \pm 12$	1 1
27	$y^2 = 4ax$ $y^2 = 8x$	1 1
28	$[\bar{a} + \bar{b}, \bar{b} + \bar{c}, \bar{c} + \bar{a}] = \begin{vmatrix} 1 & 1 & 0 \\ 0 & 1 & 1 \\ 1 & 0 & 1 \end{vmatrix} [\bar{a}, \bar{b}, \bar{c}]$ $2[\bar{a}, \bar{b}, \bar{c}]$	1 1
29	$x + 2y - 2z + 5/2 = 0$ Distance = $\frac{ d_1 - d_2 }{\sqrt{a^2 + b^2 + c^2}} = \frac{1}{2}$	1 1
30	$2 \sin^{-1} x > \frac{\pi}{2}$ Solution set is $(1/2, 1]$	1 1
31	$[A, B] = \begin{bmatrix} 2 & 2 & 1 & 5 \\ 1 & -1 & 1 & 1 \\ 3 & 1 & 2 & 4 \end{bmatrix}$ $\begin{bmatrix} 1 & -1 & 1 & 1 \\ 0 & 4 & -1 & 3 \\ 0 & 0 & 0 & -2 \end{bmatrix}$ $\rho(A) = 2, \quad \rho[A, B] = 3$ The system is inconsistent and has no solution	1 1 1
32	$ (2x - 3) + (2y - 1)i ^2 = 9$ $(2x - 3)^2 + (2y - 1)^2 = 9$ $4x^2 + 4y^2 - 12x - 4y + 1 = 0$, the locus of z in Cartesian form.	1 1 1
33	$z = \sin \frac{\pi}{10} + i \cos \frac{\pi}{10}, \quad 1/z = \sin \frac{\pi}{10} - i \cos \frac{\pi}{10}$ $= \left(\frac{1+z}{1+1/z}\right)^{10} = z^{10}$ $= i^{10} \left(\cos \frac{\pi}{10} - i \sin \frac{\pi}{10}\right)^{10} = 1$	1 1 1
34	$p + q = -\frac{n}{l}, \quad pq = \frac{n}{l}$ $\sqrt{\frac{p}{q}} + \sqrt{\frac{q}{p}} = \frac{p+q}{\sqrt{pq}} = -\sqrt{n/l}$ $\sqrt{\frac{p}{q}} + \sqrt{\frac{q}{p}} + \sqrt{\frac{n}{l}} = 0$	1 1 1
35	$y^2 - 9y + 20 = 0$ $x^2 = 4$ and $x^2 = 5$	1 1

Q.Number	Answer	Marks
	$x = \pm 2$ and $x = \pm\sqrt{5}$	1
36	$\sin^{-1}\left(\sin\frac{5\pi}{9}\cos\frac{\pi}{9}\cos\frac{5\pi}{9}\sin\frac{\pi}{9}\right) = \sin^{-1}\left(\sin\left(\frac{5\pi}{9} + \frac{\pi}{9}\right)\right)$ $\sin^{-1}\left(\sin\left(\pi - \frac{\pi}{3}\right)\right) = \sin^{-1}\left(\sin\frac{\pi}{3}\right)$ $= \frac{\pi}{3} \in \left[-\frac{\pi}{2}, \frac{\pi}{2}\right]$	1 1 1
37	$a^2 = 25, \quad b^2 = 9, \quad e = 4/5$ Centre: (h,k) = (0,0) Foci: $(\pm ae, 0) = (\pm 4, 0)$ Vertices: $(\pm a, 0) = (\pm 5, 0)$	1 1 1
38	i) vector equation of the parametric form $\vec{r} = \vec{a} + t\vec{b} \Rightarrow \vec{r} = (\vec{i} + 2\vec{j} - 3\vec{k}) + t(4\vec{i} + 5\vec{j} - 7\vec{k})$ ii) vector equation of the non-parametric form $(\vec{r} - \vec{a}) \times \vec{b} = 0$ $\Rightarrow (\vec{r} - (\vec{i} + 2\vec{j} - 3\vec{k})) \times (4\vec{i} + 5\vec{j} - 7\vec{k}) = 0$ iii) Cartesian equation $\frac{x-1}{4} = \frac{y-2}{5} = \frac{z+3}{-7}$	1 1 1
39	$\vec{r} = \vec{a} + t\vec{b}$ $\overline{DF} = \overline{OF} - \overline{OD} = (2t + 2)\hat{i} + (3t - 6)\hat{j} + t\hat{k}$ $\vec{b} \cdot \overline{DF} = 0 \Rightarrow t = 1$ \therefore The coordinate of F is (3, -1, 4)	1 1 1
40	The Parabola is open downward At (10,10) $4a=10$ \therefore The equation is $x^2 = -10y$ 	1 1 1
Part IV		
Note:	Answer all the questions	7 x 5 = 35

Q.Number	Answer	Marks
41 a)	$[A, B] = \begin{bmatrix} 1 & 1 & 3 & 0 \\ 4 & 3 & \lambda & 0 \\ 2 & 1 & 2 & 0 \end{bmatrix}$ $= \begin{bmatrix} 1 & 1 & 3 & 0 \\ 2 & 1 & 2 & 0 \\ 4 & 3 & \lambda & 0 \end{bmatrix} R_2 \leftrightarrow R_3$ $= \begin{bmatrix} 1 & 1 & 3 & 0 \\ 0 & -1 & -4 & 0 \\ 0 & -1 & \lambda - 12 & 0 \end{bmatrix} R_2 \rightarrow R_2 - 2, R_3 \rightarrow R_3 - 4R_1$ $= \begin{bmatrix} 1 & 1 & 3 & 0 \\ 0 & -1 & -4 & 0 \\ 0 & 0 & \lambda - 8 & 0 \end{bmatrix} R_3 \rightarrow R_3 - R_2$ <p>$\lambda \neq 8$ unique solution $\lambda = 8$ non-trivial solution</p>	<p>1</p> <p>1</p> <p>1</p> <p>1</p> <p>1</p>
41 b)	$\tan^{-1} \left[\frac{y-1}{x} \right] - \tan^{-1} \left[\frac{y}{x+2} \right] = \pi/4$ $\tan^{-1} \left[\frac{\frac{y-1}{x} - \frac{y}{x+2}}{1 + \left(\frac{y-1}{x} \right) \left(\frac{y}{x+2} \right)} \right] = \pi/4$ $\left[\frac{(x+2)(y-1) - xy}{x(x+2)} \right] = \tan \pi/4$ $\frac{(x+2)(y-1) - xy}{x(x+2) + y(y-1)} = 1$ $x^2 + y^2 + 3x - 3y + 2 = 0$	<p>1</p> <p>1</p> <p>1</p> <p>1</p>
42 a)	$\frac{(x-2)^2}{25} - \frac{(y-1)^2}{11} = 1$ <p>$a^2=25, b^2=11, e=6/5$ centre (2,1) Foci (8,1) (-4,1)</p> 	<p>1</p> <p>1</p> <p>1</p> <p>1</p> <p>1</p>
42b)	$\begin{bmatrix} 2 & 3 & -1 \\ 1 & 1 & 1 \\ 3 & -1 & -1 \end{bmatrix} \begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} 9 \\ 9 \\ -1 \end{bmatrix}$ $ A = 16$ $adj A = \begin{bmatrix} 0 & 4 & 4 \\ 4 & 1 & -3 \\ -4 & 11 & -1 \end{bmatrix}$ $A^{-1} = \frac{1}{16} \begin{bmatrix} 0 & 4 & 4 \\ 4 & 1 & -3 \\ -4 & 11 & -1 \end{bmatrix}$ $X = A^{-1}B \quad x=2, y=3, z=4$	<p>1</p> <p>1</p> <p>1</p> <p>1</p>
43 a)	$z^3 = -8i$ $= 8^{\frac{1}{3}}(-1)^{\frac{1}{3}}z = 2 \left[\cos \left(\frac{-\pi + 4k\pi}{6} \right) + i \sin \left(\frac{-\pi + 4k\pi}{6} \right) \right]$ <p>If $k=0$ then $z = \sqrt{3} - i$ If $k=1$ then $z=2i$ If $k=2$ then $z = -\sqrt{3} - i$</p>	<p>1</p> <p>2</p> <p>2</p>
43 b)	$\hat{a} = \cos \alpha \hat{i} - \sin \alpha \hat{j}$ $\hat{b} = \cos \beta \hat{i} + \sin \beta \hat{j}$	<p>1</p>

Q.Number	Answer	Marks
	 $\hat{a} \cdot \hat{b} = \cos \alpha \cos \beta - \sin \alpha \sin \beta$ $\hat{a} \cdot \hat{b} = \cos(\alpha + \beta)$ $\cos(\alpha + \beta) = \cos \alpha \cos \beta - \sin \alpha \sin \beta$	<p>1</p> <p>1</p> <p>1</p> <p>1</p>
44 a)	$(x - 2)(x - 3)(x - 7)(x + 2) + 19 = 0$ $y^2 - 8y - 65 = 0$ $y = 13, -5$ <p>Solution $\frac{5 \pm \sqrt{77}}{2}, \frac{5 \pm \sqrt{5}}{2}$</p>	<p>2</p> <p>1</p> <p>2</p>
44 b)	$\vec{a} = 2\hat{i} + 3\hat{j} + 6\hat{k}$ $\vec{u} = 2\hat{i} + 3\hat{j} + \hat{k}$ $\vec{v} = 2\hat{i} - 5\hat{j} - 3\hat{k}$ $\vec{u} \times \vec{v} = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 2 & 3 & 1 \\ 2 & -5 & -3 \end{vmatrix} = -4\hat{i} + 8\hat{j} - 16\hat{k}$ $(\vec{r} - \vec{a}) \cdot (\vec{u} \times \vec{v}) = 0$ <p>Vector equation $\vec{r} \cdot (\hat{i} - 2\hat{j} + 4\hat{k}) = 20$</p> <p>Cartesian equation $x - 2y + 4z = 20$</p>	<p>1</p> <p>1</p> <p>1</p> <p>1</p> <p>1</p>
45 a)	$\tan^{-1} \left[\frac{x + y + z - xyz}{1 - xy - yz - zx} \right] = \pi$ $\frac{x + y + z - xyz}{1 - xy - yz - zx} = \tan \pi = 0$ $x + y + z = xyz$	<p>3</p> <p>1</p> <p>1</p>
45 b)	 $\frac{x^2}{36} + \frac{y^2}{9} = 1$ $x = 1.5$ $y = 2.90$ <p>truck will clear the semielliptical arch</p>	<p>1</p> <p>1</p> <p>1</p> <p>1</p> <p>1</p>
46 a)	$y = -\frac{5}{12}x + \frac{3}{4}$ $m = -\frac{5}{12} \quad c = \frac{3}{4}$ $a^2 = 9 \quad b^2 = 1$ <p>LHS $\frac{3}{4}$</p> <p>RHS $\sqrt{9 \left(\frac{25}{144} \right)} - 1 = \frac{3}{4}$</p> <p>Point of contact $(5, -\frac{4}{3})$</p>	<p>1</p> <p>1</p> <p>1</p> <p>1</p> <p>1</p>

Q.Number	Answer	Marks
46 b)	 <p> $x = 2, x = 3, x = 1/2, x = 1/3$ </p>	<p>1</p> <p>1</p> <p>1</p> <p>1</p> <p>1</p>
47 a)	$\sin \alpha = 1/\sqrt{5}$ $\cos \alpha = 2/\sqrt{5}$ $\cos \beta = 4/5$ $\sin \beta = 3/5$ $\sin(\alpha - \beta) = \sin \alpha \cos \beta - \cos \alpha \sin \beta$ $= \frac{1}{\sqrt{5}} \cdot \frac{4}{5} - \frac{2}{\sqrt{5}} \cdot \frac{3}{5}$ $= \frac{4-6}{5\sqrt{5}} = \frac{-2}{5\sqrt{5}} = \frac{-2\sqrt{5}}{25}$	<p>1</p> <p>1</p> <p>1</p> <p>1</p> <p>1</p>
47 b)	$\vec{a} \times \vec{b} = 11\hat{i} - 7\hat{j} + \hat{k}$ $(\vec{a} \times \vec{b}) \times \vec{c} = -19\hat{i} - 34\hat{j} - 29\hat{k}$ $(\vec{a} \cdot \vec{c})\vec{b} = -33\hat{i} - 55\hat{j} - 22\hat{k}$ $(\vec{b} \cdot \vec{c})\vec{a} = -14\hat{i} - 21\hat{j} + 7\hat{k}$ $(\vec{a} \cdot \vec{c})\vec{b} - (\vec{b} \cdot \vec{c})\vec{a} = -19\hat{i} - 34\hat{j} - 29\hat{k}$	<p>1</p> <p>1</p> <p>1</p> <p>1</p> <p>1</p>