

**XII STD**  
**VELLORE EDUCATIONAL DISTRICT**  
**HALF YEARLY EXAMINATION, DEC-2025**

**SUB: MATHEMATICS**

(ANSWER KEY-EM)

Max.Marks:90

**PART - I (20 x 1= 20)**

Q.No	Correct Choice	Correct Answer
1	d)	$(A^T)^2$
2	d)	consistent
3	c)	$1 + i$
4	d)	2
5	b)	-4
6	a)	$\frac{-7}{2}$
7	c)	[1,2]
8	d)	Cannot define
9	d)	$(-3, 2)$
10	a)	$45^\circ$
11	c)	0
12	d)	$\frac{1}{5}$
13	d)	$-x + \frac{\pi}{2}$
14	b)	$\frac{\pi a^3}{6}$
15	b)	$\frac{\pi}{a}$
16	d)	$y = ce^{-\int P dx}$
17	b)	4
18	b)	0.96
19	c)	Multiplication
20	b)	$P \vee T \equiv P$

**PART - II (7 x 2 = 14)**

Answer any 7 questions. Q.No. 30 is compulsory.

21	$A^{-1} = \pm \frac{1}{\sqrt{ adjA }} (adjA) \rightarrow (1)$  $A^{-1} = \pm \frac{1}{6} \begin{bmatrix} 0 & -2 & 0 \\ 6 & 2 & -6 \\ -3 & 0 & 6 \end{bmatrix} \rightarrow (1)$
22	$(\sin \frac{\pi}{6} + i \cos \frac{\pi}{6})^{18} = -1 i S(3\pi) \rightarrow (1)$ $= -1 \times (-1) = +1 \rightarrow (1)$
23	$b^2 - 4ac = 0 \rightarrow (1)$ $k = 1, 4 \rightarrow (1)$
24	$\cos^{-1}(-\cos \frac{\pi}{4}) \rightarrow (1)$ $\cos^{-1}(\cos(\pi - \frac{\pi}{4})) = \frac{3\pi}{4} \rightarrow (1)$
25	$[\vec{a}, \vec{b}, \vec{c}] = 0$ $\begin{vmatrix} 2 & 3 & 1 \\ 1 & -2 & 2 \\ 3 & 1 & 3 \end{vmatrix} = 0 \rightarrow (1)$ $\Rightarrow$ Coplanar Vectors $\rightarrow (1)$
26	$dg = g'(x)dx$ $dg = (2x + \cos x)dx \rightarrow (2^*)$
27	$\int_0^1 x^2(1-x)^3 dx = \frac{m! \times n!}{(m+n+1)!} \rightarrow (1)$ $= \frac{1}{60} \rightarrow (1)$
28	$\int_{-\infty}^{\infty} f(x) dx = 1 \rightarrow (1)$ $k = 4 \rightarrow (1)$
29	$A \vee B = \begin{bmatrix} 1 & 1 & 1 & 1 \\ 1 & 1 & 1 & 1 \\ 1 & 0 & 0 & 1 \end{bmatrix} \rightarrow (1)$ $(A \vee B) \wedge C = \begin{bmatrix} 1 & 1 & 0 & 1 \\ 0 & 1 & 1 & 0 \\ 1 & 0 & 0 & 1 \end{bmatrix} \rightarrow (1)$
30	Locus $x^2 + y^2 = a^2 - b^2 \rightarrow (1)$ $x^2 + y^2 = \frac{1}{9} - \frac{1}{16} = \frac{7}{144} \rightarrow (1)$

**PART -III ( 7x3=21)**

Answer any 7 questions. Q.No. 40 is compulsory

Q.NO.	ANSWER KEY
31	$\Delta = 17 ; \Delta_x = -34 ; \Delta_y = 51 \rightarrow(2)$ $(x, y) = (-2, 3) \rightarrow(1)$
32	$(-2\omega)^6 + (-2\omega^2)^6 \rightarrow(2^*)$ $= 64 + 64 = 128 \rightarrow(1)$
33	One root is $x = 1 \rightarrow(1)$ $x^2 - 2x - 35 = 0 \rightarrow(1)$ $x = 1, 7, -5 \rightarrow(1)$
34	$a = 2 \rightarrow(1)$ Center $(-1, \frac{3}{2}) \rightarrow(1)$ radius $= \frac{\sqrt{5}}{2} \rightarrow(1)$
35	$m = \frac{dy}{dx} = 5 \rightarrow(1)$ Tangent $5x - y - 3 = 0 \rightarrow(1)$ Normal $x + 5y - 11 = 0 \rightarrow(1)$
36	$I = \int_2^3 \frac{\sqrt{x}}{\sqrt{x} + \sqrt{5-x}} dx \rightarrow(1)$ $I = \int_2^3 \frac{\sqrt{5-x}}{\sqrt{5-x} + \sqrt{x}} dx \rightarrow(1)$ $I = \frac{1}{2} \rightarrow(1)$
37	$y^1 = 8Ae^{8x} - 8Be^{-8x} \rightarrow(1)$ $y^{11} = 64Ae^{8x} + 64Be^{-8x} \rightarrow(1)$ $y^{11} = 64y \rightarrow(1)$
38	$\mu = E(X) = 7 \rightarrow(1)$ $E(X^2) = 65 \rightarrow(1)$ $\sigma^2 = V(X) = 65 - 49 = 16 \rightarrow(1)$
39	'*' Satisfies Closure Axiom $\rightarrow(2^*)$ $3 * \left(\frac{-7}{15}\right) = \frac{-88}{15} \rightarrow(1)$
40	Degree $n = -1 \rightarrow(1)$ $x \frac{\partial f}{\partial x} + y \frac{\partial f}{\partial y} = -f \rightarrow(2^*)$

**PART - IV ( 7 x 5 = 35)**

Answer All the questions::

41(a)	$[A/B] = \begin{bmatrix} 1 & 2 & -1 & 3 \\ 0 & -6 & 5 & -4 \\ 0 & 0 & 1 & 4 \end{bmatrix} \rightarrow(3)$ $(x, y, z) = (-1, 4, 4) \rightarrow(2)$																																													
41(b)	Rough Diagram $\rightarrow(1)$ $\frac{dV}{dt} = 30 \rightarrow(1)$ $V = \frac{\pi}{12} h^3 \rightarrow(1)$ $\frac{dh}{dt} = \frac{6}{5\pi} \rightarrow(2)$																																													
42(a)	$\tan^{-1} \left[ \frac{\frac{x-1}{x-2} + \frac{x+1}{x+2}}{1 - \left(\frac{x-1}{x-2}\right)\left(\frac{x+1}{x+2}\right)} \right] = \frac{\pi}{4} \rightarrow(2)$ $2x^2 - 4 = -3 \rightarrow(2)$ $x = \pm \frac{1}{\sqrt{2}} \rightarrow(1)$																																													
42(b)	<table border="1" style="width: 100%; text-align: center;"> <thead> <tr> <th><math>\neg q</math></th> <th><math>\neg q \vee r</math></th> <th><math>p \rightarrow (\neg q \vee r)</math></th> <th><math>\neg p</math></th> <th><math>\neg p \vee (\neg q \vee r)</math></th> </tr> </thead> <tbody> <tr><td>F</td><td>T</td><td>T</td><td>F</td><td>T</td></tr> <tr><td>F</td><td>F</td><td>F</td><td>F</td><td>F</td></tr> <tr><td>T</td><td>T</td><td>T</td><td>F</td><td>T</td></tr> <tr><td>T</td><td>T</td><td>T</td><td>F</td><td>T</td></tr> <tr><td>F</td><td>T</td><td>T</td><td>T</td><td>T</td></tr> <tr><td>F</td><td>F</td><td>T</td><td>T</td><td>T</td></tr> <tr><td>T</td><td>T</td><td>T</td><td>T</td><td>T</td></tr> <tr><td>T</td><td>T</td><td>T</td><td>T</td><td>T</td></tr> </tbody> </table> <p style="text-align: right;">For Table <math>\rightarrow(4)</math> <math>p \rightarrow (\neg q \vee r) \equiv \neg p \vee (\neg q \vee r) \rightarrow(1)</math></p>	$\neg q$	$\neg q \vee r$	$p \rightarrow (\neg q \vee r)$	$\neg p$	$\neg p \vee (\neg q \vee r)$	F	T	T	F	T	F	F	F	F	F	T	T	T	F	T	T	T	T	F	T	F	T	T	T	T	F	F	T	T	T	T	T	T	T	T	T	T	T	T	T
$\neg q$	$\neg q \vee r$	$p \rightarrow (\neg q \vee r)$	$\neg p$	$\neg p \vee (\neg q \vee r)$																																										
F	T	T	F	T																																										
F	F	F	F	F																																										
T	T	T	F	T																																										
T	T	T	F	T																																										
F	T	T	T	T																																										
F	F	T	T	T																																										
T	T	T	T	T																																										
T	T	T	T	T																																										
43(a)	Rough Diagram $\rightarrow(1)$ $x^2 = -4ay \rightarrow(1)$ $a = \frac{9}{4} \rightarrow(1)$ <b>Angle of Projection</b> = $\tan^{-1} \left(\frac{4}{3}\right) \rightarrow(2)$																																													
43(b)	Rough Diagram $\rightarrow(1)$ $A = \int_0^{\pi/2} \cos x dx - \int_{\pi/2}^{\pi} \cos x dx \rightarrow(2)$ $Area = 2 \rightarrow(2)$																																													

44(a)	$\frac{(x+5)^2}{36} + \frac{(y-4)^2}{4} = 1 \quad \rightarrow(2)$ $\text{Foci} = (-5 \pm 4\sqrt{2}, 4) \quad \rightarrow(1)$ $\text{Vertices} = (1, 4), (-11, 4) \quad \rightarrow(1)$ $2a = 12 \quad \& \quad 2b = 4 \quad \rightarrow(1)$
44(b)	$\frac{dA}{dt} = kA \quad \rightarrow(1)$ $A = Ce^{kt} \quad \rightarrow(1)$ $t = 0 \Rightarrow C = A_0 \quad \rightarrow(1)$ $t = 5 \Rightarrow e^{5k} = 3 \quad \rightarrow(1)$ $t = 5 \Rightarrow A = 9A_0 \quad \rightarrow(1)$
45(a)	<p>Rough Diagram <math>\rightarrow(1)</math></p> $\vec{a} = \cos \alpha \vec{i} + \sin \alpha \vec{j}$ $\vec{b} = \cos \beta \vec{i} + \sin \beta \vec{j} \quad \rightarrow(1)$ $\vec{b} \times \vec{a} = \vec{k}(\sin \alpha \cos \beta - \cos \alpha \sin \beta) \rightarrow(1)$ $\vec{b} \times \vec{a} = \vec{k} \sin(\alpha + \beta) \quad \rightarrow(1)$ $\sin(\alpha - \beta) = \sin \alpha \cos \beta - \cos \alpha \sin \beta \quad \rightarrow(1)$
45(b)	<p>Rough Diagram <math>\rightarrow(1)</math></p> $A = 3x + \frac{48}{x} + 30 \quad \rightarrow(1)$ $\frac{dA}{dx} = 0 \Rightarrow x = 4 \quad \& \quad \frac{d^2A}{dx^2} = > 0 \quad \rightarrow(2)$ $\text{Dimensions} = 6, 9 \quad \rightarrow(1)$
46(a)	$\vec{a} = \vec{i} - \vec{j} + 3\vec{k}$ $\vec{u} = 2\vec{i} - \vec{j} + 4\vec{k}$ $\vec{v} = \vec{i} + 2\vec{j} + \vec{k} \quad \rightarrow(1)$ <p><b>Parametric Vector equation</b></p> $\vec{r} = \vec{i} - \vec{j} + 3\vec{k} + s(2\vec{i} - \vec{j} + 4\vec{k})$ $+ t(\vec{i} + 2\vec{j} + \vec{k}) \quad \rightarrow(2^*)$ $9x - 2y - 5z + 4 = 0 \quad \rightarrow(2^*)$
46(b)	$\mathbf{n} = \mathbf{6}; \mathbf{p} = \frac{1}{5}; \mathbf{q} = \frac{4}{5} \quad \rightarrow(1)$ $\mathbf{p(x)} = \mathbf{6C_x} \left(\frac{1}{5}\right)^x \left(\frac{4}{5}\right)^{6-x} \quad \rightarrow(1)$ $\mathbf{p(x=2)} = \mathbf{15} \frac{4^4}{5^6} \quad \rightarrow(1)$ $\mathbf{p(x \leq 1)} = \mathbf{2} \left(\frac{4}{5}\right)^5 \quad \rightarrow(1)$ $\mathbf{p(x \geq 2)} = \mathbf{1} - \mathbf{2} \left(\frac{4}{5}\right)^5 \quad \rightarrow(1)$

47(a)	$\text{Re} \left( \frac{z-1}{z+1} \right) = 0 \quad \rightarrow(2)$ $\text{Re} \left( \frac{x-1+iy}{x+1+iy} \right) = 0 \quad \rightarrow(2)$ $x^2 + y^2 = 1 \quad \rightarrow(1)$
47(b)	$x^3 dx + y^3 dy = -(2xy^2 dx + 2yx^2 dy) \quad \rightarrow(2)$ $\int x^3 dx + \int y^3 dy = -\int d(x^2 y^2) + C \quad \rightarrow(2)$ $\frac{x^4}{4} + \frac{y^4}{4} = -x^2 y^2 + C \quad \rightarrow(1)$ <p>Note: Award full mark for alternate method also</p>

**(Note: Award full for correct alternate method also. If necessary give stage marks.)**