XII STANDARD
HALF YEARLY EXAMINATION, DEC-2023

SUB: MATHEMATICS (ANSWER KEY-EM)
Max.Marks:90

PART - I (20 x 1= 20)

Q.No	Correct Choice	Correct Answer
1	d)	$2A^{-1}$
2	c)	0
3	a)	$1+i$
4	b)	$\frac{\pi}{2}$
5	c)	4/5
6	d)	1
7	d)	$\frac{x}{\sqrt{1+x^2}}$
8	c)	$-\pi + cot^{-1}x$
9	c)	$\frac{2}{\sqrt{3}}$
10	c)	3
11	b)	45°
12	b)	2
13	b)	1/5
14	b)	9
15	a)	3/2
16	b)	$\frac{a}{2}\int_0^a f(x)dx$
17	b)	0
18	c)	0.25
19	b)	multiplication
20	d)	-2

PART **- II (7 x 2 = 14)**
Answer any 7 questions. Q.No. 30 is compulsory.

21	$\lvert adjA\rvert = 9$ → (1) $A^{-1} = \frac{\pm 1}{3}\begin{bmatrix} -1 & 2 & 2 \\ 1 & 1 & 2 \\ 2 & 2 & 1 \end{bmatrix}$ → (1)
22	$z = 5 + i$ →(1) $Z^{-1} = \frac{5}{36} - \frac{i}{26}$ →(1)
23	$cos^{-1}\left(\frac{1}{2}\right) + sin^{-1}(-1) = \frac{\pi}{3} + \frac{-\pi}{2}$ →(1) $= \frac{-\pi}{6}$ →(1)
24	$x_1^2 + y_1^2 + 2gx_1 + 2fy_1 + c$ $= -11$ →(1) Point lies inside the circle →(1)
25	**Mere attempt →(2)**
26	Vertical Asymptote $y = x - 9$ →(1) Slant asymptote $x = -3$ →(1)
27	$\cos\left[\lim_{(x,y)\to(0,0)} e^x \times \lim_{(x,y)\to(0.0)} \frac{siny}{y}\right]$ →(1) $= \cos(1)$ →(1)
28	**Order = 2** →(1) *Degree does not exist* →(1)
29	$A \vee B = \begin{pmatrix} 1 & 1 \\ 1 & 1 \end{pmatrix}$ →(1) $A \wedge B = \begin{pmatrix} 0 & 1 \\ 0 & 1 \end{pmatrix}$ →(1)
30	$\int_0^{\pi/2} sinx^5 = \frac{8}{15}$ → (1+1)

PART -III (7x3=21)

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

Q.NO.	ANSWER KEY	
31	$\Delta = 5\ ;\ \Delta_1 = 10\ ;\ \Delta_2 = 15$	→(2)
	$x = \frac{1}{2}\ ;\ y = 3$	→(1)
32	$\lvert(x-4)+iy\rvert^2 - \lvert(x-1)+iy\rvert^2 = 16$	→(1)
	$6x + 1 = 0$	→(2)
33	Sum of the roots $= \frac{25}{17}$	→(1)
	Product of roots $= \frac{-91}{17}$	→(1)
	$17x^2 - 25x - 91 = 0$	→(1)
34	$a = 4$	→(1)
	$slope\ \ m = 1$	→(1)
	$x - y + 4 = 0$	→(1)
35	$\begin{vmatrix} 2 & m+1 & -1 \\ 2 & 3 & 4 \\ 1 & 2 & 1 \end{vmatrix} = 0$	→(1)
	$m = \frac{9}{2}$	→(2)
36	$L(x) = \frac{x}{32} + \frac{3}{2}$	→(2)
	$\sqrt[4]{15} = 1.968$	→(1)
37	$I = \int_0^a \frac{f(x)}{f(x)+f(a-x)}dx$	→(1)
	$I = \frac{a}{2}$	→(2)
38	$E(X) = \frac{1}{\lambda}$	→(1)
	$E(X^2) = \frac{2}{\lambda^2}$	→(1)
	$V(X) = \frac{1}{\lambda^2}$	→(1)
39	Closure property is true	→(1)
	Identity element $e = 0$	→(1)
	$Inverse\ \ x^{-1} = \frac{-x}{1-x}$	→(1)
40	$\frac{dx}{dt} = 3\ cm$	→(1)
	$\frac{dV}{dt} = 900\ cm^3$	→(2)

PART - IV (7 x 5 = 35)

Answer All the questions:

41(a)	$[A/B] = \begin{bmatrix} 1 & 1 & -3 & -1 \\ 0 & -3 & 9 & 6 \\ 0 & 0 & 0 & 0 \end{bmatrix}$	→(2)
	$\rho(A,B) = \rho(A) = 2 < 3$	→(1)
	Many solutions	
	(infinite number of solution)	→(1)
	$(x,y,z) = (1, 3t-2, t)$	→(1)
41(b)	$z^3 = 3^3(-1)$	→(2)
	$z = 3\{-1, -\omega, -\omega^2\}$	→(1)
	$z = -3, -3\omega, -3\omega^2$	→(2)
42(a)	$\alpha + \beta = \pi - cos^{-1}z$	→(2)
	$\sqrt{1-x^2}\sqrt{1-y^2} = xy + z$	→(2)
	$x^2 + y^2 + z^2 + 2xyz = 1$	→(1)
42(b)	Roots are $\sqrt{5}-\sqrt{3}, \sqrt{5}+\sqrt{3}, -\sqrt{5}+\sqrt{3}, -\sqrt{5}-\sqrt{3}$	→(2)
	Equation	
	$(x^2 - 2\sqrt{5}x + 2)(x^2 + 2\sqrt{5}x + 2) = 0$	→(2)
	$x^4 - 16x^2 + 4 = 0$	→(1)
43(a)	Diagram	→(1)
	$\frac{x^2}{a^2} + \frac{y^2}{25} = 1$	→(1)
	$a = \frac{40}{3} = 13.3$	→(2)
	$2a = \frac{80}{3} = 26.6$	→(1)
43(b)	Rough diagram	→(1)
	$\vec{a}\,.\,\vec{c} - \vec{a}\,.\,\vec{b} = 0$	→(1)
	$\vec{b}\,.\,\vec{a} - \vec{b}\,.\,\vec{c} = 0$	→(1)
	Adding $\vec{a}\,.\,\vec{c} - \vec{b}\,.\,\vec{c} = 0$	→(1)
	$\overrightarrow{CO}\,.\,\overrightarrow{AB} = 0$	→(1)
44(a)	Rough diagram	→(1)
	$y = \frac{108-x^2}{4x}$	→(1)
	$V'(x) = 0 \implies x = 6\ \&\ V''(x) < 0$	→(2)
	Dimensions are 6cm; 6cm ; 3cm	→(1)

44(b)

$f(x,y) = \frac{x+y}{\sqrt{x}+\sqrt{y}} = \sin u$ →(1)

f is a homogeneous with

degree $n = \frac{1}{2}$ →(1)

$x\frac{\partial(\sin u)}{\partial x} + y\frac{\partial(\sin u)}{\partial y} = \frac{1}{2}\sin u$ →(2)

$\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y} = \frac{1}{2}\tan u$ →(1)

45(a)

Rough diagram →(1)

y= -1,2 →(1)

$A = \int_c^d [x_R - x_L]\, dy$ →(1)

$= \int_{-1}^{2} [y + 2 - y^2]\, dy$ →(1)

$= \frac{9}{2}$ →(1)

45(b)

$\frac{dA}{dt} = kA$ →(1)

$A = Ce^{kt}$ →(1)

$C = A_0$ →(1)

$t = 50\left(\frac{log3}{log2}\right)$years →(2)

46(a)

$k = 8$ →(2)

Cumulative function →(2)

x	0	1	2
F(x)	$\frac{1}{8}$	$\frac{3}{8}$	1

$P(X \geq 1) = \frac{7}{8}$ →(1)

46(b)

Mere attempt → (5)

47(a)

$P = -3cotx \;;\; Q = sin2x$ →(1)

$IF = cosec^3x$ →(1)

$ycosec^3x = -2cosecx + c$ →(2)

$ycosec^3x = -2cosecx + 4$ →(1)

47(b)

Mere attempt → (5)

Note: Award full marks for correct alternate method also.