DIRECTORATE OF GOVERNMENT EXAMINATIONS, CHENNAI – 600 006
HIGHER SECONDARY SECOND YEAR PUBLIC EXAMINATION – MAY 2022
MATHEMATICS MARKING SCHEME – ENGLISH MEDIUM

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 answers should be given full credit with suitable distribution.

3. Follow the footnotes which are given under 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.

5. In the case of Part II, Part III 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. One mark to write the correct option and the corresponding answer.
2. If one of them (answer or option) is wrong, then award zero mark only.

Code A			Code B		
Q.No	Option	Answer	**Q.No**	Option	Answer
1.	(b)	1	**1.**	(d)	$\frac{1}{10100}$
2.	(c)	$F(x)$ is real valued decreasing function	**2.**	(d)	$\frac{1}{(x+1)^2}\,dx$
3.	(d)	$\frac{1}{(x+1)^2}\,dx$	**3.**	(a)	If A is a square matrix of order n and λ is a scalar then $Adj(\lambda A) = \lambda^n (Adj\ A)$
4.	(d)	$\frac{1}{10100}$	**4.**	(b)	24
5.	(d)	$\frac{\pi}{6}$	**5.**	(c)	$\frac{2}{27}$
6.	(a)	19	**6.**	(d)	$y = c\,e^{-\int p\,dx}$
7.	(b)	$\frac{-q}{r}$	**7.**	(a)	$x^2 + y^2$
8.	(a)	$x^2 + y^2$	**8.**	(a)	19
9.	(c)	**9**	**9.**	(c)	$\cot x$
10.	(a)	0	**10.**	(a)	Multiplication
11.	(d)	-3	**11.**	(c)	$F(x)$ is real valued decreasing function
12.	(d)	$x^2 + y^2 + 6x + 8y + 16 = 0$	**12.**	(c)	**9**
13.	(d)	$y = c\,e^{-\int p\,dx}$	**13.**	(a)	0
14.	(c)	$\frac{2}{27}$	**14.**	(b)	$\frac{-q}{r}$
15.	(a)	$(1,0)$	**15.**	(d)	$x^2 + y^2 + 6x + 8y + 16 = 0$
16.	(a)	$\frac{\pi}{2}$	**16.**	(b)	1
17.	(a)	Multiplication	**17.**	(a)	$\frac{\pi}{2}$
18.	(a)	If A is a square matrix of order n and λ is a scalar then $Adj(\lambda A) = \lambda^n (Adj\ A)$	**18.**	(a)	$(1,0)$
19.	(c)	$\cot x$	**19.**	(d)	$\frac{\pi}{6}$
20.	(b)	24	**20.**	(d)	-3

Important Note for Part – II, Part – III and Part – IV

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 to the related steps instead of denying the entire marks meant for the stage.

PART – II

<table>
<tr><th>Q.NO</th><th>CONTENT</th><th>MARKS</th></tr>
<tr><td>21.</td><td>$z = x + iy, \bar{z} = x - iy$
$Re(z) = \frac{z+\bar{z}}{2}$ and $Im(z) = \frac{z-\bar{z}}{2i}$</td><td>1
1</td></tr>
<tr><td>22.</td><td>$2 + \sqrt{3}$ is also a root
$x^2 - 4x + 1 = 0$</td><td>1
1</td></tr>
<tr><td>23.</td><td>$tany = \sqrt{3}$
$y = \frac{\pi}{3}$</td><td>1
1</td></tr>
<tr><td>24.</td><td>$\frac{dy}{dx} = 3x^2 - 6x + 1 = 1$
Required points are $(0, -2)$ and $(2, -4)$</td><td>1
1</td></tr>
<tr><td>25.</td><td>$df = (2x + 3)\, dx$
$df = 0.7$</td><td>1
1</td></tr>
<tr><td>26.</td><td>$\frac{dy}{dx} = Ae^x - Be^{-x}$
$\frac{d^2y}{dx^2} - y = 0$</td><td>1
1</td></tr>
<tr><td>27.</td><td>$\frac{dy}{\sqrt{1-y^2}} = \frac{dx}{\sqrt{1-x^2}}$
$\sin^{-1} y = \sin^{-1} x + c$</td><td>1
1</td></tr>
<tr><td>28.</td><td>$k = \frac{1}{30}$</td><td>2</td></tr>
<tr><td>29.</td><td><table><tr><td>Values of random variable</td><td>0</td><td>1</td><td>2</td><td>3</td></tr><tr><td>Number of elements in the inverse images</td><td>1</td><td>3</td><td>3</td><td>1</td></tr></table></td><td>2</td></tr>
<tr><td>30.</td><td>$\left\lvert\frac{3(0)+6(0)+2(0)+7}{\sqrt{(3)^2+(6)^2+(2)^2}}\right\rvert = 1$
Distance from the origin to the plane $3x + 6y + 2z + 7 = 0$ is 1.</td><td>1
1</td></tr>
</table>

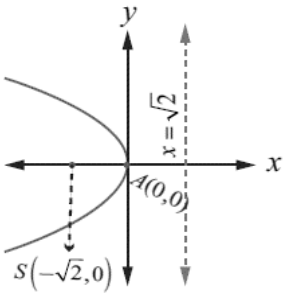
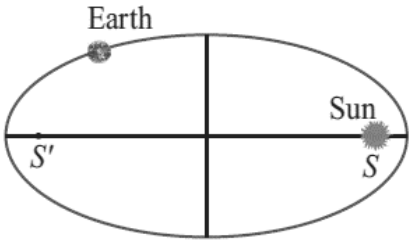
PART – III

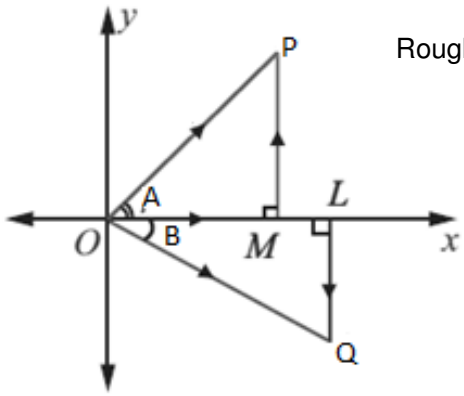
Q. NO	CONTENT	MARKS
31.	$\begin{vmatrix} 1 & 2 & -1 \\ 3 & -1 & 2 \\ 1 & -2 & 3 \end{vmatrix} = -8 \neq 0$	2
	Rank of the matrix $= 3$	1
	Note: Any other third order minor which does not vanish. One can do by rank Method	
32.	$A^{-1} = \frac{1}{4}\begin{pmatrix} 2 & -2 \\ -3 & 5 \end{pmatrix}$	2
	$x = -1\,, y = 4$	1
33.	$z_1 = 1 + i, z_2 = 10 - 8i, z_3 = 11 + 6i$	
	$\lvert z_2 - z_1 \rvert = \sqrt{162}$	1
	$\lvert z_3 - z_1 \rvert = \sqrt{125}$	1
	z_3 is closer to z_1	1
34.	The other factor is $2x^2 - 7x + 3$	1
	$x = \frac{1}{2}\,, 3$	2
35.	$\vec{r} \times \vec{F} = -\hat{\imath} - 2\hat{k}$	1
	Magnitude of the torque = $\sqrt{5}$	1
	Direction cosines of the torque $\left(\frac{-1}{\sqrt{5}}, 0, \frac{-2}{\sqrt{5}}\right)$	1
36.	$\lim_{x\to\infty} \frac{2 - \frac{3}{x^2}}{1 - \frac{5}{x} + \frac{3}{x^2}}$	2
	$= 2$	1
	Note: One can solve the problem by using L'Hopital Rule.	
37.	$A = \pi r^2$	1
	$dA \simeq 2\pi r\, dr$	1
	$= 0.4\,\pi$	1

38.	$\int_0^{\pi/3} \frac{secx\ tanx}{1+sec^2x}\ dx$	
	$= \int_1^2 \frac{dz}{1+z^2} = [tan^{-1}z]_1^2$	2
	$= tan^{-1}(2) - \frac{\pi}{4}$	1
39.	$*$ is a binary operation on $\mathbb{R}$.	1
	$3 * \left(\frac{-7}{15}\right) = 3 + \left(\frac{-7}{15}\right) + 3\left(\frac{-7}{15}\right) - 7$	1
	$= \frac{-88}{15}$	1
40.	$(x+4)(x+1) + (y+2)(y+1) = 0$	2*
	$x^2 + y^2 + 5x + 3y + 6 = 0$	1

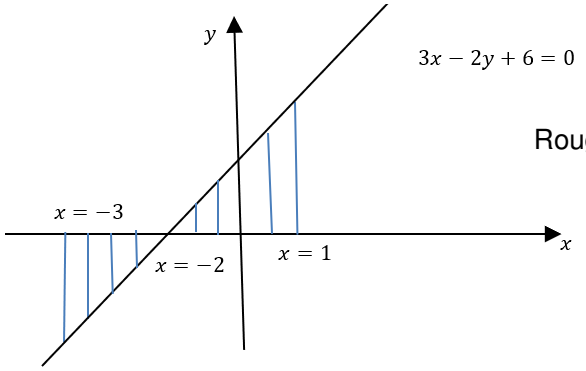
PART – IV

Q. NO	CONTENT	MARKS
41.(a)	$\Delta = 0$	3
	Cramer's rule is not applicable	2
	OR	
41.(b)	$f'(x) = 24x^5 - 24x^3$	1
	$f''(x) = 120x^4 - 72x^2$	1
	$f''(-1) = f''(1) = 48$	1+1
	$\therefore f(x)$ has local minimum attains at -1 and 1	1
42.(a)	$\lvert x + iy + i \rvert = \lvert x + iy - 1 \rvert$	1
	$x^2 + (y+1)^2 = (x-1)^2 + y^2$	2
	$x + y = 0$	2

	OR	
42.(b)	$I = \int_0^a \frac{f(x)}{f(x)+f(a-x)}\,dx$	1
	$I = \int_0^a \frac{f(a-x)}{f(a-x)+f(x)}\,dx$	2*
	$2I = \int_0^a dx = a$	1
	$I = \frac{a}{2}$	1
43.(a)	 Rough Diagram	1
	Vertex $(0,0)$	1
	$a = \sqrt{2}$	1
	$y^2 = -4\sqrt{2}x$	2
	OR	
43.(b)	$\cot^{-1}(1) + \sin^{-1}\left(\frac{-\sqrt{3}}{2}\right) - \sec^{-1}\left(-\sqrt{2}\right)$	
	$= \frac{\pi}{4} - \frac{\pi}{3} - \frac{3\pi}{4}$	3
	$= -\frac{5\pi}{6}$	2
44.(a)	 Rough Diagram	1
	$a + c = 152 \times 10^6$	1
	$a - c = 94.5 \times 10^6$	1
	$2c = 575 \times 10^5$	1
	The distance from the sun to the other focus = 575×10^5 km	1

	OR	
44.(b)	 Rough Figure $\overrightarrow{OP} = \cos A\,\hat{\imath} + \sin A\,\hat{\jmath}$ $\overrightarrow{OQ} = \cos B\,\hat{\imath} - \sin B\,\hat{\jmath}$ Remaining part	1 1 1 2
45.(a)	$\vec{a} = 2\hat{\imath} + 2\hat{\jmath} + \hat{k}$ $\vec{b} = 9\hat{\imath} + 3\hat{\jmath} + 6\hat{k}$ $\vec{v} = 2\hat{\imath} + 6\hat{\jmath} + 6\hat{k}$ Vector equation of the plane is $\vec{r} = (1-s)(2\hat{\imath} + 2\hat{\jmath} + \hat{k}) + s(9\hat{\imath} + 3\hat{\jmath} + 6\hat{k}) + t(2\hat{\imath} + 6\hat{\jmath} + 6\hat{k})$ OR Cartesian equation of the plane is $3x + 4y - 5z - 9 = 0$	1+1+1 2*
	OR	
45.(b)	$m_1 = 2, \quad m_2 = \frac{1}{2}$ $\tan\theta = \frac{3}{4}$ $\theta = \tan^{-1}\left(\frac{3}{4}\right)$	1+1 2* 1
46.(a)	(i) $P(X < 3) = \frac{1}{2}$ (ii) $P(2 < X < 4) = \frac{1}{2}$ (iii) $P(3 \leq X) = \frac{1}{2}$	1 2 2
	OR	

46.(b)



1

Required Area $= -\int_{-3}^{-2} \frac{3x+6}{2}\,dx + \int_{-2}^{1} \frac{3x+6}{2}\,dx$ 2

$= \frac{15}{2}$ 2

47.(a)

$$\frac{dy}{1+y^2} = \frac{dx}{1+x^2}$$ 2

$$\int \frac{dy}{1+y^2} = \int \frac{dx}{1+x^2}$$ 1

$$\tan^{-1} y = \tan^{-1} x + c$$ 2

OR

47.(b)

p	q	r	$q \to r$	$p \wedge q$	$p \to (q \to r)$	$(p \wedge q) \to r$
T	T	T	T	T	T	T
T	T	F	F	T	F	F
T	F	T	T	F	T	T
T	F	F	T	F	T	T
F	T	T	T	F	T	T
F	T	F	F	F	T	T
F	F	T	T	F	T	T
F	F	F	T	F	T	T

4

$$p \to (q \to r) \equiv (p \wedge q) \to r$$ 1

Note: i) The order of rows and columns need not be same as in the scheme

ii) If any mistake in the table then award two marks for the table.