DEPARTMENT OF GOVERNMENT EXAMINATIONS, CHENNAI – 600 006

HIGHER SECONDARY SECOND YEAR EXAMINATION – MARCH 2019

MATHEMATICS MARKING SCHEME – ENGLISH MEDIUM

GENERAL INSTRUCTIONS

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.

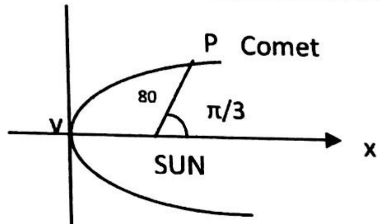
6. Answers written only in Black or Blue ink should be evaluated.

PART – I

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

(CODE A)			(CODE B)		
Q.No	Option	Answer	Q.No	Option	Answer
1	(4)	$\frac{1}{11}$	1	(4)	3
2	(1)	$\frac{9}{4}$	2	(1)	3
3	(4)	3	3	(4)	trivial solution and infinitely many non trivial solutions
4	(3)	$g(x)$ is an identity function	4	(1)	$pv\ (\sim p)$
5	(4)	second quadrant	5	(3)	$(y')^2 - xy' + y = 0$
6	(1)	$pv\ (\sim p)$	6	(2)	8
7	(2)	8	7	(4)	$\frac{1}{11}$
8	(2)	$xz\ plane$	8	(4)	second quadrant
9	(1)	The curve has a point of inflection in which y''does not exist	9	(2)	$\frac{\pi}{2}$
10	(2)	collinear	10	(1)	$\frac{9}{4}$
11	(4)	trivial solution and infinitely many non trivial solutions	11	(1)	The curve has a point of inflection in which y'' does not exist
12	(3)	$(y')^2 - xy' + y = 0$	12	(1)	$\frac{1}{K}\ I$
13	(3)	2, 2	13	(4)	$x + 3 = 0$
14	(4)	0	14	(2)	$xz\ plane$
15	(1)	3	15	(3)	$g(x)$ is an identity function
16	(4)	16π	16	(2)	collinear
17	(2)	$\frac{\pi}{2}$	17	(3)	1
18	(4)	$x + 3 = 0$	18	(4)	0
19	(1)	$\frac{1}{K}\ I$	19	(3)	2, 2
20	(3)	1	20	(4)	16π

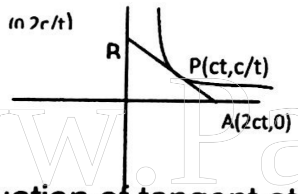
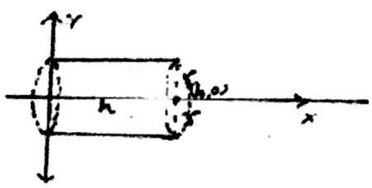
PART – II

Q.NO	CONTENT	MARKS
21	x+y+z=30	1
	x+2y+5z=100	1
22	$\overrightarrow{3i} + \overrightarrow{2j} + \overrightarrow{9k} = \lambda(\vec{i} + \overrightarrow{mj} + \overrightarrow{3k})$	1
	m = 2/3	1
	Note : This problem can be done using cross product or some other methods	
23	$\frac{1+i}{1-i} = i$	1
	$i^n = 1$, => n=4	1
24		2
	Note : Any type of parabola can be used	
25	$f'(x) = \cos x$	1
	$x = (2n+1)\pi/2, \; n \in Z$	1
26.	Domain : $(-\infty, \infty)$ or R	1
	Horizontal Extent: $(-\infty, \infty)$ or R Vertical Extent: $(-\infty, \infty)$ or R	1
27.	$\int_{\frac{\pi}{6}}^{\frac{\pi}{3}} \frac{dx}{1+\sqrt{\cot x}} = \int_{\frac{\pi}{6}}^{\frac{\pi}{3}} \frac{dx}{1+\sqrt{\cot\left(\frac{\pi}{6}+\frac{\pi}{3}-x\right)}}$	1
	$= \int_{\frac{\pi}{6}}^{\frac{\pi}{3}} \frac{dx}{1+\sqrt{\tan x}}$	1
28.	Sum of two non zero rational numbers need not be a rational number	1
	It is not closed	1
	Note : If anybody prove this result by giving a counter example then award full mark	
29	$F(3) = \int_0^3 3e^{-3x}\,dx$	1
	$= 1 - e^{-9}$	1
30.	f is continuous in [1,6]	1
	f is not differentiable in (1,6)	1

Important Note for Part III and 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 – III

31.	Writing the matrices A and B of order 3 finding rank of A + B proving $\rho(A) + \rho(B) \neq \rho(A + B)$	1 1 1
32.	$\vec{a} \times \vec{b} = \overrightarrow{-i} + \overrightarrow{2j} + \overrightarrow{2k}$ Required vectors=$\pm[\overrightarrow{-2i} + \overrightarrow{4j} + \overrightarrow{4k}]$ (or)any other form	1 2*
33	z= sinθ – icosθ $\left(\frac{1+\sin\theta - i\cos\theta}{1+\sin\theta + i\cos\theta}\right)^n = (z)^n$ = cosn(π/2 – θ)- i sin n(π/2 – θ)	1 1 1
	Note : Instead of z= sinθ – icosθ one may take z= sinθ + icosθ and get the answer	
34	 Diagram Equation of tangent at 't', $x + yt^2 = 2ct$	1 1
	Midpoint of AB is (ct, c/t)	1
35.	$f'(x) = \frac{\cos x - \sin x}{1+(\sin x + \cos x)^2}$ $f'(x) = \frac{\cos x - \sin x}{1+(\sin x + \cos x)^2} > 0$ f(x) is strictly increasing in $(0, \frac{\pi}{4})$	1 1 1
36.	degree of the function is -1 $x\frac{\partial f}{\partial x} + y\frac{\partial f}{\partial y} = -f$	1 2*
37.	**Diagram**  $V = \pi\int_0^h r^2\, dx$ $= \pi r^2 h$ Note : One may use y axis instead of x axis.	1 1 1

38.

p	q	$p \wedge q$	p v q	$p \wedge q \rightarrow$ p v q
T	T	T	T	T
T	F	F	T	T
F	T	F	T	T
F	F	F	F	T

Marks: 2

$(p \wedge q) \rightarrow (p \vee q)$ is tautology — 1

Note : 1. The order of rows and columns need not be same as in the scheme.
2. Give 1 mark for incorrect table.

39.	n = 120, p= 1/3, q = 2/3	1
	Mean= np= 40	1
	Variance= npq = 80/3	1
40	$x^3 e^x dx + \frac{dy}{y} = 0$	1
	$(x^3 - 3x^2 + 6x - 6)e^x$+logy = c	2*

PART-IV

41.(a)

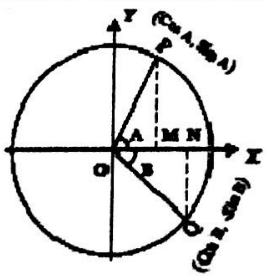
$$[A,B] = \begin{pmatrix} 1 & 1 & 3 & 0 \\ 4 & 3 & \mu & 0 \\ 2 & 1 & 2 & 0 \end{pmatrix}$$ — 1

$$\sim \begin{pmatrix} 1 & 1 & 3 & 0 \\ 0 & -1 & \mu-12 & 0 \\ 0 & 0 & 8-\mu & 0 \end{pmatrix}$$ — 2

Case (i)	$\mu \neq 8$ trivial solution	1
Case (ii)	$\mu = 8$ Infinitely many solutions	1

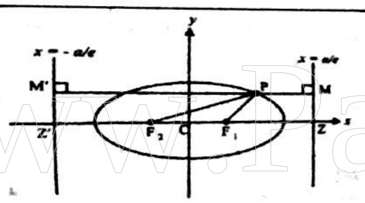
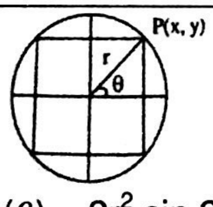
Note : One may get a different Echelon form

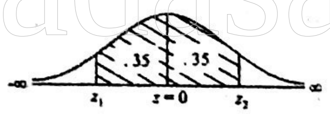
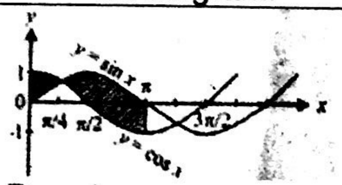
(b)



Marks: 2

$\overrightarrow{OP} = \cos A\ \vec{i} + \sin A\ \vec{j}$	1
$\overrightarrow{OQ} = \cos B\ \vec{i} - \sin B\ \vec{j}$	1
Remaining part	1

42.(a)	$(x_1, y_1, z_1) = (-1, 1, -1)$ $(x_2, y_2, z_2) = (2, 2, 1)$	1
	$(l, m, n) = (2, 3, -2)$	1
	$\begin{vmatrix} x+1 & y-1 & z+1 \\ 3 & 1 & 2 \\ 2 & 3 & -2 \end{vmatrix} = 0$	2*
	$8x - 10y - 7z + 11 = 0$	1
	Note : (1) Any one of the two given points can be taken as first point (2) Without writing (x_1, y_1, z_1) (x_2, y_2, z_2) and (l, m, n), one may write the determinant equation directly. In such case, award full mark if the answer is correct.	
(b)	$(x^6 + 1)(x^5 - 1) = 0$	1
	$x = \text{cis}\,\frac{(2k+1)\pi}{6}$, k = 0, 1, 2 , 3 , 4 , 5	2
	$x = \text{cis}\,\frac{2k\pi}{5}$, k = 0, 1, 2,3,4	2
43.(a)	 Rough Diagram	1
	Proving $F_1P + F_2P = 2a$.	1
	$a^2 = \frac{81}{4}$	1
	$b^2 = \frac{45}{4}$	1
	Eqn of ellipse is $\frac{x^2}{\frac{81}{4}} + \frac{y^2}{\frac{45}{4}} = 1$	1
(b)	 Rough Diagram	1
	$A(\theta) = 2r^2 \sin 2\theta$	1
	$A'(\theta) = 4r^2 \cos 2\theta$ $A''(\theta) = -8r^2 \sin 2\theta$	1
	The dimensions are $\sqrt{2}\, r, \sqrt{2}\, r$	1
	Area $= 2r^2$	1
	Note : One can do the problem even without differentiation	

44. a)	$v = \frac{dx}{dt} = 100 - 25t$	1
	(i) $v = 100$	1
	(ii) t = 4 sec	1
	(iii) Maximum height = 200 m	1
	(iv) $v = -100$ m/sec	1
(b)	$\frac{(y+1)^2}{16} - \frac{(x-1)^2}{9} = 1$	1
	centre: (1, -1)	1
	Foci : (1 , 4) (1 , -6)	1
	Vertices: (1 , 3) (1, -4)	1
	Rough Diagram	1
45.(a)	$\mu = 34$, $\sigma = 16$	1
	Rough Diagram 	1
	$z_1 = -1.04$, $z_2 = 1.04$	1
	$Upper\ Limit = 50.64$	1
	$Lower\ Limit = 17.36$	1
	Note : Even without diagram one can do the problem. Then, don't deduct the mark for diagram.	
b.	 Rough Diagram	2
	Req. Area: $= \int_0^{\frac{\pi}{4}}(\cos x - \sin x)dx + \int_{\frac{\pi}{4}}^{\pi}(\sin x - \cos x)dx$	2*
	$=2\sqrt{2}$	1

46. (a)	$\frac{dw}{dt} = \frac{\partial w}{\partial x} \cdot \frac{dx}{dt} + \frac{\partial w}{\partial y} \cdot \frac{dy}{dt} + \frac{\partial w}{\partial z} \cdot \frac{dz}{dt}$	1
	= - sint + 2 cost + 2t .... (A)	2
	Verification :	
	w = cost + 2sint + t^2	1
	$\frac{dw}{dt}$ = -sint + 2cost + 2t .... (B)	1
(b)	T – 15 = ce ^{kt} or any other format	1
	finding c=85	1
	t=5, T=60, $e^{5k} = \frac{45}{85}$	1
	t=10, T = 15 + 85 e ^{10k}	1
	= 38.82°c	1
47.(a)	(i) The identity element of a group is unique	1
	(ii) Inverse of each element of a group is unique	1
	(iii) a*b = a*c => b =c b*a = c*a => b=c	1
	Note : The order of the elements a, b and c may be changed.	
	(iv) $(a^{-1})^{-1} = a$	1
	(v) $(a*b)^{-1} = b^{-1} * a^{-1}$	1
(b)	C.F = $Ae^{2x} + B e^{-2/5 x}$	1
	P.I$_1$= $-\frac{5}{12} x.e^{-\frac{2}{5}x}$	1
	P.I$_2$= $-\frac{2}{7} e^x$	1
	P.I$_3$= $-\frac{3}{4}$	1
	y= $Ae^{2x} + B e^{-2/5 x} - \frac{5}{12} x.e^{-\frac{2}{5}x} - \frac{2}{7} e^x - \frac{3}{4}$	1