SUMMER– 2019 EXAMINATION

Subject Name: Applied Mathematics **Model Answer** **Subject Code: 22201**

Important Instructions to Examiners:

1) The answers should be examined by key words and not as word-to-word as given in the model answer scheme.
2) The model answer and the answer written by candidate may vary but the examiner may try to assess the understanding level of the candidate.
3) The language errors such as grammatical, spelling errors should not be given more Importance (Not applicable for subject English and Communication Skills.
4) While assessing figures, examiner may give credit for principal components indicated in the figure. The figures drawn by candidate and model answer may vary. The examiner may give credit for any equivalent figure drawn.
5) Credits may be given step wise for numerical problems. In some cases, the assumed constant values may vary and there may be some difference in the candidate's answers and model answer.
6) In case of some questions credit may be given by judgement on part of examiner of relevant answer based on candidate's understanding.
7) For programming language papers, credit may be given to any other program based on equivalent concept.

Q. No.	Sub Q.N.	Answers	Marking Scheme
1.		**Attempt any FIVE of the following:**	**10**
	a)	Define Implicit function with suitable example.	**02**
	Ans	Implicit Function: If the variables x and y are not separated from each other from the function $f(x,y)=0$ then function is called implicit function. e.g. $x^2+xy+y^2=0$	2
	b)	State whether the function $f(x)=\frac{e^x-e^{-x}}{2}$, is even or odd.	**02**
	Ans	$f(x)=\frac{e^x-e^{-x}}{2}$ $\therefore f(-x)=\frac{e^{-x}-e^{-(-x)}}{2}$ $\therefore f(-x)=\frac{e^{-x}-e^{x}}{2}=\frac{-(e^x-e^{-x})}{2}$	1
		$\therefore f(-x)=-f(x)$	1
		$\therefore$ function is odd.	

Q. No.	Sub Q.N.	Answers	Marking Scheme
1.	c)	Find $\frac{dy}{dx}$; if $y=\left(x^4+2x\right)\cdot\sin 3x$	**02**
	Ans	$y=\left(x^4+2x\right)\cdot\sin 3x$	
		$\therefore \frac{dy}{dx}=\left(x^4+2x\right)\frac{d}{dx}\left(\sin 3x\right)+\sin 3x\frac{d}{dx}\left(x^4+2x\right)$	
		$=\left(x^4+2x\right)\cos 3x\left(3\right)+\sin 3x\left(4x^3+2\right)$	2
		$=3\left(x^4+2x\right)\cos 3x+\sin 3x\left(4x^3+2\right)$	
	d)	Evaluate $\int x\cdot\cos x\,dx$	**02**
	Ans	$\int x\cdot\cos x\,dx$	
		$=x\int\cos x\,dx-\int\left[\int\cos x\,dx\frac{d}{dx}\left(x\right)\right]dx$	½
		$=x\sin x-\int\sin x.1\,dx$	1
		$=x\sin x-\left(-\cos x\right)+c$	½
		$=x\sin x+\cos x+c$	
	e)	Evaluate $\int\left[e^{2\log x}+e^{x\log 2}\right]dx$	**02**
	Ans	$\int\left[e^{2\log x}+e^{x\log 2}\right]dx$	
		$=\int\left[e^{\log x^2}+e^{\log 2^x}\right]dx$	½
		$=\int\left[x^2+2^x\right]dx$	½
		$=\frac{x^3}{3}+\frac{2^x}{\log 2}+c$	1
	f)	Find the area under the curve $y=x^2$ from $x=0$ to $x=3$ with x-axis.	**02**
	Ans	Area $A=\int_a^b ydx$	
		$=\int_0^3 x^2dx$	1

Q. No.	Sub Q.N.	Answers	Marking Scheme
1.	f)	$\therefore A=\left[\frac{x^3}{3}\right]_0^3$	½
		$\therefore A=\left[\frac{3^3}{3}-\frac{0}{0}\right]$	
		$\therefore A=9$	½
	g)	State Simpson`s one third rule of numerical integration.	**02**
	Ans	Simpson`s one third rule:	
		$\int_a^b f(x)\,dx=\frac{h}{3}\left[(y_0+y_n)+4(y_1+y_3+...)+2(y_2+y_4+.....)\right]$	2
		where $h=\frac{b-a}{n}$	
2.		**Attempt any THREE of the following:**	**12**
	a)	If $y=f(x)=\frac{x-5}{5x-1}$, show that $f(y)=x$.	**04**
	Ans	$f(x)=\frac{x-5}{5x-1}$	
		$\therefore f(y)=\frac{y-5}{5y-1}$	
		$=\frac{\left(\frac{x-5}{5x-1}\right)-5}{5\left(\frac{x-5}{5x-1}\right)-1}$	1
		$=\frac{(x-5)-5(5x-1)}{5(x-5)-(5x-1)}$	1
		$=\frac{x-5-25x+5}{5x-25-5x+1}$	
		$=\frac{-24x}{-24}$	1
		$=x$	1
	b)	Find $\frac{dy}{dx}$, if $13x^2+2x^2y+y^3=1$	**04**

SUMMER– 2019 EXAMINATION

Subject Name: Applied Mathematics **Model Answer** **Subject Code: 22201**

Q. No.	Sub Q. N.	Answers	Marking Scheme
2.	b)	$13x^2+2x^2y+y^3=1$	
	Ans		
		$\therefore 13(2x)+2\left(x^2\dfrac{dy}{dx}+y\cdot 2x\right)+3y^2\dfrac{dy}{dx}=0$	1
		$\therefore 26x+2x^2\dfrac{dy}{dx}+4xy+3y^2\dfrac{dy}{dx}=0$	1
		$\therefore \dfrac{dy}{dx}\left(2x^2+3y^2\right)=-26x-4xy$	1
		$\therefore \dfrac{dy}{dx}=\dfrac{-26x-4xy}{2x^2+3y^2}$	1
		--	
	c)	A metal wire 40 cm long is bent to form a rectangle. Find its dimensions when area is maximum.	**04**
	Ans	Let length of rectangle $=x$, breadth $=y$	
		$\therefore 2x+2y=40$	
		$\therefore y=20-x$	
		Area $A=x\times y$	
		$A=x(20-x)$	1
		$\therefore A=20x-x^2$	
		$\therefore \dfrac{dA}{dx}=20-2x$	½
		$\therefore \dfrac{d^2A}{dx^2}=-2$	½
		Let $\dfrac{dA}{dx}=0$	
		$\therefore 20-2x=0$	½
		$\therefore x=10$	
		at $x=10$	½
		$\dfrac{d^2A}{dx^2}=-2<0$	½
		Area is maximum at $x=10$	
		Length $=10$; breadth $=10$	½
		--	

SUMMER–2019 EXAMINATION

Subject Name: Applied Mathematics **Model Answer** **Subject Code: 22201**

Q. No.	Sub Q.N.	Answers	Marking Scheme
2.	d)	Show that radius of curvature at any point on the curve $y = a\log\left(\sec\frac{x}{a}\right)$, Where a is constant is $a\sec\frac{x}{a}$.	**04**
	Ans	$y = a\log\left(\sec\left(\frac{x}{a}\right)\right)$	
		$\frac{dy}{dx} = a\frac{1}{\sec\left(\frac{x}{a}\right)}\sec\left(\frac{x}{a}\right)\tan\left(\frac{x}{a}\right)\left(\frac{1}{a}\right)$	1
		$\frac{dy}{dx} = \tan\left(\frac{x}{a}\right)$	
		$\frac{d^2y}{dx^2} = \sec^2\left(\frac{x}{a}\right)\left(\frac{1}{a}\right)$	1
		$\therefore$ Radius of curvature is $\rho = \frac{\left[1+\left(\frac{dy}{dx}\right)^2\right]^{\frac{3}{2}}}{\frac{d^2y}{dx^2}}$	
		$\therefore \rho = \frac{\left[1+\tan^2\left(\frac{x}{a}\right)\right]^{\frac{3}{2}}}{\sec^2\left(\frac{x}{a}\right)\left(\frac{1}{a}\right)}$	1
		$\therefore \rho = \frac{a\left[\sec^2\left(\frac{x}{a}\right)\right]^{\frac{3}{2}}}{\sec^2\left(\frac{x}{a}\right)}$	
		$\therefore \rho = \frac{a\sec^3\left(\frac{x}{a}\right)}{\sec^2\left(\frac{x}{a}\right)}$	
		$\therefore \rho = a\sec\left(\frac{x}{a}\right)$	1
		--	
3.		**Attempt any <u>THREE</u> of the following:**	**12**

SUMMER– 2019 EXAMINATION

Subject Name: Applied Mathematics **Model Answer** **Subject Code: 22201**

Q. No.	Sub Q.N.	Answers	Marking Scheme
3.	a)	The slope of the curve $2y^3 = ax^2 + b$ at point $(1,-1)$ is same as the slope of $x + y = 0$ Find *a* and *b*.	**04**
	Ans	$2y^3 = ax^2 + b \quad -----(1)$	
		$\therefore 6y^2 \frac{dy}{dx} = 2ax$	
		$\therefore \frac{dy}{dx} = \frac{2ax}{6y^2}$	
		$\therefore \frac{dy}{dx} = \frac{ax}{3y^2}$	1
		at $(1,-1)$	
		$\frac{dy}{dx} = \frac{a(1)}{3(-1)^2} = \frac{a}{3} \quad ----(2)$	½
		$\because x + y = 0$	
		$\therefore 1 + \frac{dy}{dx} = 0$	
		$\therefore \frac{dy}{dx} = -1 \quad ----(3)$	1
		from (2) and (3)	
		$\frac{a}{3} = -1$	
		$\therefore a = -3$	1
		$\therefore$ From (1)	
		$2(-1)^3 = a(1)^2 + b$	
		$\therefore -2 = -3 + b$	
		$\therefore b = 1$	½
	b)	Find $\frac{dy}{dx}$, if $y = \sec^{-1}\left[\frac{1}{4x^3 - 3x}\right]$	**04**
	Ans	$y = \sec^{-1}\left[\frac{1}{4x^3 - 3x}\right]$	
		Put $x = \cos\theta \;\therefore\; \theta = \cos^{-1} x$	1
		$\therefore y = \sec^{-1}\left[\frac{1}{4\cos^3\theta - 3\cos\theta}\right]$	

Q. No.	Sub Q.N.	Answers	Marking Scheme
3.	b)	$y=\sec^{-1}\left[\frac{1}{\cos 3\theta}\right]$	½
		$\therefore y=\sec^{-1}\left[\sec 3\theta\right]$	½
		$\therefore y=3\theta$	½
		$\therefore y=3\cos^{-1}x$	½
		$\therefore \frac{dy}{dx}=\frac{-3}{\sqrt{1-x^2}}$	1
		--	
	c)	If $x=a\cos^3\theta$, $y=a\sin^3\theta$ find $\frac{dy}{dx}$ at $\theta=\frac{\pi}{4}$	**04**
	Ans	$\because x=a\cos^3\theta$,	
		$\therefore \frac{dx}{d\theta}=3a\cos^2\theta\cdot(-\sin\theta)$	1
		$\because y=a\sin^3\theta$	
		$\therefore \frac{dy}{d\theta}=3a\sin^2\theta\cdot\cos\theta$	1
		$\therefore \frac{dy}{dx}=\frac{dy/d\theta}{dx/d\theta}$	
		$\therefore \frac{dy}{dx}=\frac{3a\sin^2\theta\cdot\cos\theta}{3a\cos^2\theta\cdot(-\sin\theta)}$	1
		$\therefore \frac{dy}{dx}=-\tan\theta$	
		at $\theta=\pi/4$	
		$\therefore \frac{dy}{dx}=-\tan\pi/4$	
		$\therefore \frac{dy}{dx}=-1$	1
		--	

Q. No.	Sub Q.N.	Answers	Marking Scheme
3.	d)	Evaluate $\int \frac{e^x(x+1)}{\cos^2(xe^x)}dx$	**04**
	Ans	$\int \frac{e^x(x+1)}{\cos^2(xe^x)}dx$	
		Put $xe^x = t$	½
		$\therefore e^x(x+1)dx = dt$	
		$=\int \frac{1}{\cos^2 t}dt$	1
		$=\int \sec^2 t\, dt$	1
		$=\tan t + c$	1
		$=\tan(xe^x)+c$	½
		--	
4.		**Attempt any THREE of the following:**	**12**
	a)	Evaluate $\int \frac{\sec^2 x\, dx}{3\tan^2 x - 2\tan x - 5}$	**04**
	Ans	$I=\int \frac{\sec^2 x\, dx}{3\tan^2 x - 2\tan x - 5}$	
		Put $\tan x = t$	1
		$\therefore \sec^2 x dx = dt$	
		$=\int \frac{dt}{3t^2-2t-5}$	
		$=\frac{1}{3}\int \frac{dt}{t^2-\frac{2}{3}t-\frac{5}{3}}dt$	½
		Third term $=\left(\frac{1}{2}\times\frac{-2}{3}\right)^2=\frac{1}{9}$	
		$=\frac{1}{3}\int \frac{dt}{t^2-\frac{2}{3}t+\frac{1}{9}-\frac{1}{9}-\frac{5}{3}}$	
		$=\frac{1}{3}\int \frac{dt}{\left(t-\frac{1}{3}\right)^2-\left(\frac{4}{3}\right)^2}$	1

Q. No.	Sub Q.N.	Answers	Marking Scheme
4.	a)	$=\frac{1}{3}\cdot\frac{1}{2\times\frac{4}{3}}\log\left(\frac{t-\frac{1}{3}-\frac{4}{3}}{t-\frac{1}{3}+\frac{4}{3}}\right)+c$	1
		$=\frac{1}{8}\log\left(\frac{3t-5}{3t+3}\right)+c$	
		$I=\frac{1}{8}\log\left(\frac{3\tan x-5}{3\tan x+3}\right)+c$	½
	b)	Evaluate $\int\frac{dx}{1+\sin x+\cos x}$	**04**
	Ans	$\int\frac{dx}{1+\sin x+\cos x}$	
		Put $\tan\frac{x}{2}=t$ $\therefore\sin x=\frac{2t}{1+t^2}$ $,\cos x=\frac{1-t^2}{1+t^2},$ $dx=\frac{2dt}{1+t^2}$	1
		$\therefore\int\frac{dx}{1+\sin x+\cos x}=\int\frac{1}{1+\frac{2t}{1+t^2}+\left(\frac{1-t^2}{1+t^2}\right)}\cdot\frac{2dt}{1+t^2}$	
		$=\int\frac{2\,dt}{1+t^2+2t+1-t^2}dt$	½
		$=2\int\frac{1}{2t+2}dt$	
		$=\int\frac{dt}{t+1}$	1
		$=\log(t+1)+c$	1
		$=\log\left(\tan\frac{x}{2}+1\right)+c$	½
	c)	Evaluate $\int x^2\cos 2x\,dx$	**04**
	Ans	$I=\int x^2\cos 2x\,dx$	
		$=x^2\cdot\int\cos 2x\,dx-\int\left[\int\cos 2x\,dx\frac{d}{dx}\left(x^2\right)\right]dx$	½
		$=x^2\frac{\sin 2x}{2}-\int\frac{\sin 2x}{2}(2x)\,dx$	1
		$=2x^2\frac{\sin 2x}{2}-\int x\sin 2x\,dx$	

Q. No.	Sub Q.N.	Answers	Marking Scheme
4.	c)	$= x^2(\sin 2x) - \left[x\int(\sin 2x)\,dx - \int\left(\int(\sin 2x)\,dx\frac{d}{dx}(x)\right)\right]dx$	½
		$= x^2\sin 2x - x\left(-\frac{\cos 2x}{2}\right) + \int\left(-\frac{\cos 2x}{2}\right)1dx$	½
			½
		$= x^2\sin 2x + \frac{x}{2}\cos 2x - \frac{1}{2}\int\cos 2x\,dx$	½
		$= x^2\sin 2x + \frac{x}{2}\cos 2x - \frac{1}{4}\sin 2x + c$	½
		--	
	d)	Evaluate $\int_5^{10}\frac{dx}{(x-1)(x-2)}$	**04**
	Ans	$I = \int_5^{10}\frac{dx}{(x-1)(x-2)}$	
		Let $\frac{1}{(x-1)(x-2)} = \frac{A}{x-1} + \frac{B}{x-2}$	
		$1 = A(x-2) + B(x-1)$	
		Put $x=1 \quad \therefore A = \frac{1}{-1} = -1$	½
		Put $x=2 \quad \therefore B = \frac{1}{1} = 1$	½
		$\frac{1}{(x-1)(x-2)} = \frac{-1}{x-1} + \frac{1}{x-2}$	
		$\int_5^{10}\frac{dx}{(x-1)(x-2)} = \int_5^{10}\left[\frac{-1}{x-1} + \frac{1}{x-2}\right]dx$	
		$= \left[-\log(x-1) + \log(x-2)\right]_5^{10}$	2
		$= \left[-\log(10-1) + \log(10-2)\right] - \left[-\log(5-1) + \log(5-2)\right]$	1
		$= \left[-\log 9 + \log 8\right] - \left[-\log 4 + \log 3\right] = \log\frac{8}{9} - \log\frac{3}{4}$	
		$= \log\left[\frac{8}{9}\times\frac{4}{3}\right] = \log\frac{32}{27}$	
		--	
	e)	Evaluate $\int_3^7\frac{(10-x)^2}{x^2 + (10-x)^2}\,dx$	**04**

SUMMER– 2019 EXAMINATION

Subject Name: Applied Mathematics **Model Answer** **Subject Code: 22201**

Q. No.	Sub Q.N.	Answers	Marking Scheme
4.	e)Ans	$I=\int_3^7 \frac{(10-x)^2}{x^2+(10-x)^2}\ dx --------(1)$	
		$I=\int_3^7 \frac{[10-(10-x)]^2}{(10-x)^2+[10-(10-x)]^2}\ dx$	1
		$I=\int_3^7 \frac{x^2}{(10-x)^2+x^2}\ dx --------(2)$	½
		Adding (1) and (2)	
		$2I=\int_3^7 \frac{(10-x)^2+x^2}{(10-x)^2+x^2}dx$	1
		$2I=\int_3^7 1\,dx$	½
		$2I=[x]_3^7=7-3=4$	½
		$I=2$	½
5.		**Attempt any TWO of the following:**	**12**
	a)	Find the area of the region included between parabola $y=x^2$ and $y=4$	
	Ans	We have $y=x^2$ and $y=4$	**06**
		$\therefore x^2-4=0$	
		$\therefore x^2=4$	
		$\therefore x=\pm 2$	1
		Area $=\int_a^b (y_1-y_2)\,dx$	
		$=\int_{-2}^{2}(x^2-4)\,dx$	1
		$=\left[\frac{x^3}{3}-4x\right]_{-2}^{2}$	2
		$=\left[\frac{2^3}{3}-4(2)-\left(\frac{(-2)^3}{3}-4(-2)\right)\right]$	1
		$=\frac{-32}{3}$	
		Area is always $+ve$	
		$\therefore A=\frac{32}{3}$ or 10.667	1

SUMMER– 2019 EXAMINATION

Subject Name: Applied Mathematics **Model Answer** **Subject Code: 22201**

Q. No.	Sub Q.N.	Answers	Marking Scheme
5.	b)	Attempt the following:	**06**
	(i)	Verify that $y=\log x$ is a solution of differential equation $x\frac{d^2y}{dx^2}+\frac{dy}{dx}=0$	**03**
	Ans	$y=\log x$	
		$\therefore \frac{dy}{dx}=\frac{1}{x}$	1
		$\therefore x\frac{dy}{dx}=1$	1
		$\therefore x\frac{d^2y}{dx^2}+\frac{dy}{dx}=0$	1
		OR	
		$y=\log x$	
		$\therefore \frac{dy}{dx}=\frac{1}{x}$	1
		$\therefore \frac{d^2y}{dx^2}=-\frac{1}{x^2}$	1
		$L.H.S.=x\frac{d^2y}{dx^2}+\frac{dy}{dx}=x\left(-\frac{1}{x^2}\right)+\frac{1}{x}$	
		$=-\frac{1}{x}+\frac{1}{x}$	
		$=0=R.H.S.$	1
	ii)	Solve: $\frac{dy}{dx}=e^{2x-y}+x^2e^{-y}$	**03**
	Ans	$\frac{dy}{dx}=e^{2x-y}+x^2e^{-y}$	
		$\therefore \frac{dy}{dx}=\left(e^{2x}\cdot e^{-y}+x^2e^{-y}\right)$	
		$\therefore \frac{dy}{dx}=e^{-y}\left(e^{2x}+x^2\right)$	
		$\therefore \frac{dy}{e^{-y}}=\left(e^{2x}+x^2\right)dx$	1
		$\therefore \int e^y dy=\int\left(e^{2x}+x^2\right)dx$	1
		$\therefore e^y=\frac{e^{2x}}{2}+\frac{x^3}{3}+c$	1

Q. No.	Sub Q.N.	Answers	Marking Scheme
5.	c)	A particle starting with velocity 6 m/s has an acceleration $\left(1-t^2\right)m/s^2$. When does it first comes to rest? How far has it then travelled?	**06**
		We have	
	Ans	acceleration $=\dfrac{dv}{dt}=\left(1-t^2\right)$	
		$\therefore dv=\left(1-t^2\right)dt$	
		$\therefore \int dv=\int\left(1-t^2\right)dt$	½
		$\therefore v=t-\dfrac{t^3}{3}+c_1$	1
		At rest $t=0, v=6$ $\therefore c_1=6$	½
		$\therefore v=t-\dfrac{t^3}{3}+6$	
		When particle first comes to rest , $v=0$	
		$\therefore 0=t-\dfrac{t^3}{3}+6$	
		$\therefore 0=3t-t^3+18$	
		$\therefore t=3$, $t^2+3t+6=0$	1
		$\therefore$ Particle first time comes to rest at $t=3$	
		$v=\dfrac{dx}{dt}=t-\dfrac{t^3}{3}+6$	
		$\therefore dx=\left(t-\dfrac{t^3}{3}+6\right)dt$	
		$\therefore \int dx=\int\left(t-\dfrac{t^3}{3}+6\right)dt$	½
		$\therefore x=\dfrac{t^2}{2}-\dfrac{t^4}{12}+6t+c_2$	1
		at $t=0, x=0$ $\therefore c_2=0$	½
		$\therefore x=\dfrac{t^2}{2}-\dfrac{t^4}{12}+6t$	
		at $t=3$	
		$\therefore x=\dfrac{(3)^2}{2}-\dfrac{(3)^4}{12}+6(3)$	½
		$\therefore x=15.75\ m$	½

Q. No.	Sub Q.N.	Answers	Marking Scheme
6.	a)(i)	**Attempt any TWO of the following:**	**12**
		Attempt the following:	**06**
		Using Trapezoidal rule , calculate the approximate value of $\int_3^8 \log_e x$ by using following table.	**03**
	Ans	(see table below)	

x	3	4	5	6	7	8
$y=\log_e x$	1.098	1.3863	1.6094	1.7918	1.9458	2.0794

Trapezoidal rule

$$\int_a^b f(x)\,dx=\frac{h}{2}\left[(y_0+y_n)+2(y_1+y_2+...+y_{n-1})\right]$$

where $h=\frac{b-a}{n}=\frac{8-3}{5}=1$ — 1

$$\int_3^8 \log_e x=\frac{1}{2}\left[(1.098+2.0794)+2(1.3863+1.6094+1.7918+1.9458)\right]$$ — 1

$$=\frac{1}{2}\left[3.1774+2(6.7333)\right]$$

$$=8.322$$ — 1

Q. No.	Sub Q.N.	Answers	Marking Scheme
6.	a)(ii)	Using Simpson`s $\frac{1}{3}^{rd}$ rule ,calculate the approximate value of $\int_0^4 e^x dx$ by using following data:	**03**

x	0	1	2	3	4
$y = e^x$	1	2.72	7.39	20.09	54.60

Ans

Let $y = e^x \quad a = 0\ ,\ b = 4$ and $n = 4$

$\therefore h = \frac{b-a}{n} = \frac{4-0}{4} = 1$ — 1

Using Simpson's $1/3^{rd}$ rule

$$\int_a^b f(x)\,dx = \frac{h}{3}\left[(y_0 + y_n) + 4(y_1 + y_3 + \ldots) + 2(y_2 + y_4 + \ldots)\right]$$

$$\int_0^4 e^x dx = \frac{1}{3}\left[(1 + 54.60) + 4(2.72 + 20.09) + 2(7.39)\right]$$ — 1

$= 53.8733$ — 1

06

b) Evaluate $\int_0^1 \frac{dx}{1+x^2}$ by Trapezoidal rule,taking n = 4.Hence,obtain approximate value of π.

Ans

Trapezoidal rule

$$\int_a^b f(x)\,dx = \frac{h}{2}\left[(y_0 + y_n) + 2(y_1 + y_2 + \ldots + y_{n-1})\right]$$ — 1

where $h = \frac{b-a}{n} = \frac{1-0}{4} = \frac{1}{4}$ or 0.25 — 1

x	0	0.25	0.5	0.75	1
$y = f(x)$	1	0.9412	0.8	0.64	0.5

$$\int_0^1 \frac{dx}{1+x^2} = \frac{0.25}{2}\left[(1+0.5) + 2(0.9412 + 0.8 + 0.64)\right]$$ — 1

$$\therefore \int_0^1 \frac{dx}{1+x^2} = 0.7828 - - - - - (1)$$ — 1

$$\int_0^1 \frac{dx}{1+x^2} = \left[\tan^{-1} x\right]_0^1 = \tan^{-1}(1) - \tan^{-1}(0) = \frac{\pi}{4} - - - - - (2)$$ — 1

From (1) and (2)

$\frac{\pi}{4} = 0.7828$

$\therefore \pi = 3.1312$ — 1

Q. No.	Sub Q.N.	Answers	Marking Scheme
6.	c)	Evaluate $\int_0^{\pi/2} \sqrt{\cos x}\,dx$ using Simpson's $\frac{3}{8}$ rule with $n=8$	**06**
	Ans	$h=\frac{b-a}{n}=\frac{\frac{\pi}{2}-0}{8}=\frac{\pi}{16}$	1

x	0	$\pi/16$	$\pi/8$	$3\pi/16$	$\pi/4$	$5\pi/16$	$3\pi/8$	$7\pi/16$	$\pi/2$
y	1	0.9903	09612	0.9118	0.8409	0.7454	0.6186	0.4417	0

(Marking: 2)

Using Simpson's $3/8^{th}$ rule.

$$\int_a^b f(x)\,dx=\frac{3h}{8}\left[(y_0+y_n)+3(y_1+y_2+y_4+y_5+...)+2(y_3+y_6+...)\right]$$

$$\therefore \int_0^{\pi/2}\sqrt{\cos x}\,dx=\frac{3\left(\pi/16\right)}{8}\left[(1+0)+3(0.9903+0.9612+0.8409+0.7454+0.4417)+2(0.9118+0.6186)\right]$$ 1

$$\therefore \int_0^{\pi/2}\sqrt{\cos x}\,dx=0.3749\pi=1.178$$ 2

Important Note

In the solution of the question paper, wherever possible all the possible alternative methods of solution are given for the sake of convenience. Still student may follow a method other than the given herein. In such case, first see whether the method falls within the scope of the curriculum, and then only give appropriate marks in accordance with the scheme of marking.
