



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 <u>FIVE</u> of the following:	10
	a)	Define Implicit function with suitable example.	02
	Ans	<p><u>Implicit Function:</u></p> <p>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.</p> <p>e.g. $x^2 + xy + y^2 = 0$</p>	2
	b)	State whether the function $f(x) = \frac{e^x - e^{-x}}{2}$, is even or odd.	02
	Ans	$f(x) = \frac{e^x - e^{-x}}{2}$ $\therefore f(-x) = \frac{e^{-x} - e^{-(-x)}}{2}$ $\therefore f(-x) = \frac{e^{-x} - e^x}{2} = \frac{-(e^x - e^{-x})}{2}$ $\therefore f(-x) = -f(x)$ <p>\therefore function is odd.</p>	1
			1

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1.	c)	Find $\frac{dy}{dx}$; if $y = (x^4 + 2x) \cdot \sin 3x$	02
	Ans	$y = (x^4 + 2x) \cdot \sin 3x$ $\therefore \frac{dy}{dx} = (x^4 + 2x) \frac{d}{dx}(\sin 3x) + \sin 3x \frac{d}{dx}(x^4 + 2x)$ $= (x^4 + 2x) \cos 3x (3) + \sin 3x (4x^3 + 2)$ $= 3(x^4 + 2x) \cos 3x + \sin 3x (4x^3 + 2)$	2
	d)	Evaluate $\int x \cdot \cos x \, dx$	02
	Ans	$\int x \cdot \cos x \, dx$ $= x \int \cos x \, dx - \int \left[\int \cos x \, dx \frac{d}{dx}(x) \right] dx$ $= x \sin x - \int \sin x \cdot 1 \, dx$ $= x \sin x - (-\cos x) + c$ $= x \sin x + \cos x + c$	½ 1 ½
e)	Evaluate $\int [e^{2 \log x} + e^{x \log 2}] \, dx$	02	
Ans	$\int [e^{2 \log x} + e^{x \log 2}] \, dx$ $= \int [e^{\log x^2} + e^{\log 2^x}] \, dx$ $= \int [x^2 + 2^x] \, dx$ $= \frac{x^3}{3} + \frac{2^x}{\log 2} + c$	½ ½ 1	
f)	Find the area under the curve $y = x^2$ from $x = 0$ to $x = 3$ with x-axis.	02	
Ans	$\text{Area } A = \int_a^b y \, dx$ $= \int_0^3 x^2 \, dx$	1	

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1.	f)	$\therefore A = \left[\frac{x^3}{3} \right]_0^3$ $\therefore A = \left[\frac{3^3}{3} - \frac{0}{3} \right]$ $\therefore A = 9$	<p>½</p> <p>½</p>
	g)	<p>State Simpson`s one third rule of numerical integration.</p> <p>Ans Simpson`s one third rule:</p> $\int_a^b f(x) dx = \frac{h}{3} [(y_0 + y_n) + 4(y_1 + y_3 + \dots) + 2(y_2 + y_4 + \dots)]$ <p>where $h = \frac{b-a}{n}$</p>	<p>02</p> <p>2</p>
2.		<p>Attempt any THREE of the following:</p>	<p>12</p>
	a)	<p>If $y = f(x) = \frac{x-5}{5x-1}$, show that $f(y) = x$.</p> <p>Ans $f(x) = \frac{x-5}{5x-1}$</p> $\therefore f(y) = \frac{y-5}{5y-1}$ $= \frac{\left(\frac{x-5}{5x-1}\right) - 5}{5\left(\frac{x-5}{5x-1}\right) - 1}$ $= \frac{(x-5) - 5(5x-1)}{5(x-5) - (5x-1)}$ $= \frac{x-5-25x+5}{5x-25-5x+1}$ $= \frac{-24x}{-24}$ $= x$	<p>04</p> <p>1</p> <p>1</p> <p>1</p> <p>1</p>
	b)	<p>Find $\frac{dy}{dx}$, if $13x^2 + 2x^2y + y^3 = 1$</p>	<p>04</p>

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2.	b)	$13x^2 + 2x^2y + y^3 = 1$	
	Ans	$\therefore 13(2x) + 2\left(x^2 \frac{dy}{dx} + y \cdot 2x\right) + 3y^2 \frac{dy}{dx} = 0$ $\therefore 26x + 2x^2 \frac{dy}{dx} + 4xy + 3y^2 \frac{dy}{dx} = 0$ $\therefore \frac{dy}{dx}(2x^2 + 3y^2) = -26x - 4xy$ $\therefore \frac{dy}{dx} = \frac{-26x - 4xy}{2x^2 + 3y^2}$	<p>1</p> <p>1</p> <p>1</p> <p>1</p>
	c)	<p>A metal wire 40 cm long is bent to form a rectangle. Find its dimensions when area is maximum.</p>	04
	Ans	<p>Let length of rectangle = x , breadth = y</p> $\therefore 2x + 2y = 40$ $\therefore y = 20 - x$ <p>Area $A = x \times y$</p> $A = x(20 - x)$ $\therefore A = 20x - x^2$ $\therefore \frac{dA}{dx} = 20 - 2x$ $\therefore \frac{d^2A}{dx^2} = -2$ <p>Let $\frac{dA}{dx} = 0$</p> $\therefore 20 - 2x = 0$ $\therefore x = 10$ <p>at $x = 10$</p> $\frac{d^2A}{dx^2} = -2 < 0$ <p>Area is maximum at $x = 10$</p> <p>Length = 10 ; breadth = 10</p>	<p>1</p> <p>½</p> <p>½</p> <p>½</p> <p>½</p> <p>½</p>

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2.	d)	<p>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 $a \sec \frac{x}{a}$.</p> <p>Ans $y = a \log \left(\sec \left(\frac{x}{a} \right) \right)$</p> $\frac{dy}{dx} = a \frac{1}{\sec \left(\frac{x}{a} \right)} \sec \left(\frac{x}{a} \right) \tan \left(\frac{x}{a} \right) \left(\frac{1}{a} \right)$ $\frac{dy}{dx} = \tan \left(\frac{x}{a} \right)$ $\frac{d^2y}{dx^2} = \sec^2 \left(\frac{x}{a} \right) \left(\frac{1}{a} \right)$ <p>\therefore Radius of curvature is $\rho = \frac{\left[1 + \left(\frac{dy}{dx} \right)^2 \right]^{\frac{3}{2}}}{\frac{d^2y}{dx^2}}$</p> $\therefore \rho = \frac{\left[1 + \tan^2 \left(\frac{x}{a} \right) \right]^{\frac{3}{2}}}{\sec^2 \left(\frac{x}{a} \right) \left(\frac{1}{a} \right)}$ $\therefore \rho = \frac{a \left[\sec^2 \left(\frac{x}{a} \right) \right]^{\frac{3}{2}}}{\sec^2 \left(\frac{x}{a} \right)}$ $\therefore \rho = \frac{a \sec^3 \left(\frac{x}{a} \right)}{\sec^2 \left(\frac{x}{a} \right)}$ $\therefore \rho = a \sec \left(\frac{x}{a} \right)$	<p>04</p> <p>1</p> <p>1</p> <p>1</p>
3.		<p>Attempt any THREE of the following:</p>	12

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3.	a)	<p>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.</p> <p>Ans $2y^3 = ax^2 + b$ -----(1)</p> $\therefore 6y^2 \frac{dy}{dx} = 2ax$ $\therefore \frac{dy}{dx} = \frac{2ax}{6y^2}$ $\therefore \frac{dy}{dx} = \frac{ax}{3y^2}$ <p>at $(1, -1)$</p> $\frac{dy}{dx} = \frac{a(1)}{3(-1)^2} = \frac{a}{3}$ -----(2) <p>$\therefore x + y = 0$</p> $\therefore 1 + \frac{dy}{dx} = 0$ $\therefore \frac{dy}{dx} = -1$ -----(3) <p>from (2) and (3)</p> $\frac{a}{3} = -1$ $\therefore a = -3$ <p>\therefore From (1)</p> $2(-1)^3 = a(1)^2 + b$ $\therefore -2 = -3 + b$ $\therefore b = 1$	<p>04</p> <p>1</p> <p>1/2</p> <p>1</p> <p>1</p> <p>1/2</p>
	b)	<p>Find $\frac{dy}{dx}$, if $y = \sec^{-1} \left[\frac{1}{4x^3 - 3x} \right]$</p> <p>Ans $y = \sec^{-1} \left[\frac{1}{4x^3 - 3x} \right]$</p> <p>Put $x = \cos \theta \therefore \theta = \cos^{-1} x$</p> $\therefore y = \sec^{-1} \left[\frac{1}{4\cos^3 \theta - 3\cos \theta} \right]$	<p>04</p> <p>1</p>

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3.	b)	$y = \sec^{-1} \left[\frac{1}{\cos 3\theta} \right]$ $\therefore y = \sec^{-1} [\sec 3\theta]$ $\therefore y = 3\theta$ $\therefore y = 3 \cos^{-1} x$ $\therefore \frac{dy}{dx} = \frac{-3}{\sqrt{1-x^2}}$	<p>1/2</p> <p>1/2</p> <p>1/2</p> <p>1/2</p> <p>1</p>
	c)	<p>If $x = a \cos^3 \theta$, $y = a \sin^3 \theta$ find $\frac{dy}{dx}$ at $\theta = \frac{\pi}{4}$</p> <p>Ans $\therefore x = a \cos^3 \theta$,</p> $\therefore \frac{dx}{d\theta} = 3a \cos^2 \theta \cdot (-\sin \theta)$ $\therefore y = a \sin^3 \theta$ $\therefore \frac{dy}{d\theta} = 3a \sin^2 \theta \cdot \cos \theta$ $\therefore \frac{dy}{dx} = \frac{dy/d\theta}{dx/d\theta}$ $\therefore \frac{dy}{dx} = \frac{3a \sin^2 \theta \cdot \cos \theta}{3a \cos^2 \theta \cdot (-\sin \theta)}$ $\therefore \frac{dy}{dx} = -\tan \theta$ <p>at $\theta = \frac{\pi}{4}$</p> $\therefore \frac{dy}{dx} = -\tan \frac{\pi}{4}$ $\therefore \frac{dy}{dx} = -1$	<p>04</p> <p>1</p> <p>1</p> <p>1</p> <p>1</p>



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3.	d)	Evaluate $\int \frac{e^x(x+1)}{\cos^2(xe^x)} dx$	04
	Ans	$\int \frac{e^x(x+1)}{\cos^2(xe^x)} dx$ <p>Put $xe^x = t$ $\therefore e^x(x+1)dx = dt$</p> $= \int \frac{1}{\cos^2 t} dt$ $= \int \sec^2 t dt$ $= \tan t + c$ $= \tan(xe^x) + c$	<p>1/2</p> <p>1</p> <p>1</p> <p>1</p> <p>1/2</p>
4.		Attempt any <u>THREE</u> of the following:	12
	a)	Evaluate $\int \frac{\sec^2 x dx}{3 \tan^2 x - 2 \tan x - 5}$	04
	Ans	$I = \int \frac{\sec^2 x dx}{3 \tan^2 x - 2 \tan x - 5}$ <p>Put $\tan x = t$ $\therefore \sec^2 x dx = dt$</p> $= \int \frac{dt}{3t^2 - 2t - 5}$ $= \frac{1}{3} \int \frac{dt}{t^2 - \frac{2}{3}t - \frac{5}{3}}$ <p>Third term = $\left(\frac{1}{2} \times \frac{-2}{3}\right)^2 = \frac{1}{9}$</p> $= \frac{1}{3} \int \frac{dt}{t^2 - \frac{2}{3}t + \frac{1}{9} - \frac{1}{9} - \frac{5}{3}}$ $= \frac{1}{3} \int \frac{dt}{\left(t - \frac{1}{3}\right)^2 - \left(\frac{4}{3}\right)^2}$	<p>1</p> <p>1/2</p> <p>1</p>

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4.	a)	$= \frac{1}{3} \cdot \frac{1}{2 \times \frac{4}{3}} \log \left(\frac{t - \frac{1}{3} - \frac{4}{3}}{t - \frac{1}{3} + \frac{4}{3}} \right) + c$ $= \frac{1}{8} \log \left(\frac{3t-5}{3t+3} \right) + c$ $I = \frac{1}{8} \log \left(\frac{3 \tan x - 5}{3 \tan x + 3} \right) + c$	1
	b)	<p>Evaluate $\int \frac{dx}{1 + \sin x + \cos x}$</p> <p>Ans $\int \frac{dx}{1 + \sin x + \cos x}$</p> <p>Put $\tan \frac{x}{2} = t \quad \therefore \sin x = \frac{2t}{1+t^2}, \cos x = \frac{1-t^2}{1+t^2}, dx = \frac{2dt}{1+t^2}$</p> $\therefore \int \frac{dx}{1 + \sin x + \cos x} = \int \frac{1}{1 + \frac{2t}{1+t^2} + \left(\frac{1-t^2}{1+t^2} \right)} \cdot \frac{2dt}{1+t^2}$ $= \int \frac{2dt}{1+t^2+2t+1-t^2}$ $= 2 \int \frac{1}{2t+2} dt$ $= \int \frac{dt}{t+1}$ $= \log(t+1) + c$ $= \log \left(\tan \frac{x}{2} + 1 \right) + c$	1/2 04 1 1/2
	c)	<p>Evaluate $\int x^2 \cos 2x dx$</p> <p>Ans $I = \int x^2 \cos 2x dx$</p> $= x^2 \cdot \int \cos 2x dx - \int \left[\int \cos 2x dx \frac{d}{dx}(x^2) \right] dx$ $= x^2 \frac{\sin 2x}{2} - \int \frac{\sin 2x}{2} (2x) dx$ $= 2x^2 \frac{\sin 2x}{2} - \int x \sin 2x dx$	04 1/2 1

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4.	c)	$= x^2 (\sin 2x) - \left[x \int (\sin 2x) dx - \int \left(\int (\sin 2x) dx \frac{d}{dx}(x) \right) dx \right]$ $= x^2 \sin 2x - x \left(-\frac{\cos 2x}{2} \right) + \int \left(-\frac{\cos 2x}{2} \right) dx$ $= x^2 \sin 2x + \frac{x}{2} \cos 2x - \frac{1}{2} \int \cos 2x dx$ $= x^2 \sin 2x + \frac{x}{2} \cos 2x - \frac{1}{4} \sin 2x + c$	<p>1/2</p> <p>1/2</p> <p>1/2</p> <p>1/2</p> <p>1/2</p>
	d)	<p>Evaluate $\int_5^{10} \frac{dx}{(x-1)(x-2)}$</p> <p>Ans $I = \int_5^{10} \frac{dx}{(x-1)(x-2)}$</p> <p>Let $\frac{1}{(x-1)(x-2)} = \frac{A}{x-1} + \frac{B}{x-2}$</p> $1 = A(x-2) + B(x-1)$ <p>Put $x=1 \therefore A = \frac{1}{-1} = -1$</p> <p>Put $x=2 \therefore B = \frac{1}{1} = 1$</p> $\frac{1}{(x-1)(x-2)} = \frac{-1}{x-1} + \frac{1}{x-2}$ $\int_5^{10} \frac{dx}{(x-1)(x-2)} = \int_5^{10} \left[\frac{-1}{x-1} + \frac{1}{x-2} \right] dx$ $= [-\log(x-1) + \log(x-2)]_5^{10}$ $= [-\log(10-1) + \log(10-2)] - [-\log(5-1) + \log(5-2)]$ $= [-\log 9 + \log 8] - [-\log 4 + \log 3] = \log \frac{8}{9} - \log \frac{3}{4}$ $= \log \left[\frac{8}{9} \times \frac{4}{3} \right] = \log \frac{32}{27}$	<p>04</p> <p>1/2</p> <p>1/2</p> <p>2</p> <p>1</p>
	e)	<p>Evaluate $\int_3^7 \frac{(10-x)^2}{x^2 + (10-x)^2} dx$</p>	04

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4.	e)Ans	$I = \int_3^7 \frac{(10-x)^2}{x^2 + (10-x)^2} dx \text{----- (1)}$ $I = \int_3^7 \frac{[10 - (10-x)]^2}{(10-x)^2 + [10 - (10-x)]^2} dx$ $I = \int_3^7 \frac{x^2}{(10-x)^2 + x^2} dx \text{----- (2)}$ <p>Adding (1) and (2)</p> $2I = \int_3^7 \frac{(10-x)^2 + x^2}{(10-x)^2 + x^2} dx$ $2I = \int_3^7 1 dx$ $2I = [x]_3^7 = 7 - 3 = 4$ $I = 2$	<p>1</p> <p>½</p> <p>1</p> <p>½</p> <p>½</p> <p>½</p>
5.	a) Ans	<p>Attempt any <u>TWO</u> of the following:</p> <p>Find the area of the region included between parabola $y = x^2$ and $y = 4$</p> <p>We have $y = x^2$ and $y = 4$</p> $\therefore x^2 - 4 = 0$ $\therefore x^2 = 4$ $\therefore x = \pm 2$ $\text{Area} = \int_a^b (y_1 - y_2) dx$ $= \int_{-2}^2 (x^2 - 4) dx$ $= \left[\frac{x^3}{3} - 4x \right]_{-2}^2$ $= \left[\frac{2^3}{3} - 4(2) - \left(\frac{(-2)^3}{3} - 4(-2) \right) \right]$ $= \frac{-32}{3}$ <p>Area is always +ve</p> $\therefore A = \frac{32}{3} \text{ or } 10.667$	<p>12</p> <p>06</p> <p>1</p> <p>1</p> <p>2</p> <p>1</p> <p>1</p>

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5.	b)	Attempt the following:	06
	(i)	Verify that $y = \log x$ is a solution of differential equation $x \frac{d^2 y}{dx^2} + \frac{dy}{dx} = 0$	03
	Ans	$y = \log x$ $\therefore \frac{dy}{dx} = \frac{1}{x}$ $\therefore x \frac{dy}{dx} = 1$ $\therefore x \frac{d^2 y}{dx^2} + \frac{dy}{dx} = 0$ <p>OR</p> $y = \log x$ $\therefore \frac{dy}{dx} = \frac{1}{x}$ $\therefore \frac{d^2 y}{dx^2} = -\frac{1}{x^2}$ $L.H.S. = x \frac{d^2 y}{dx^2} + \frac{dy}{dx} = x \left(-\frac{1}{x^2} \right) + \frac{1}{x}$ $= -\frac{1}{x} + \frac{1}{x}$ $= 0 = R.H.S.$	1 1 1 1 1
	ii)	Solve: $\frac{dy}{dx} = e^{2x-y} + x^2 e^{-y}$	03
	Ans	$\frac{dy}{dx} = e^{2x-y} + x^2 e^{-y}$ $\therefore \frac{dy}{dx} = (e^{2x} \cdot e^{-y} + x^2 e^{-y})$ $\therefore \frac{dy}{dx} = e^{-y} (e^{2x} + x^2)$ $\therefore \frac{dy}{e^{-y}} = (e^{2x} + x^2) dx$ $\therefore \int e^y dy = \int (e^{2x} + x^2) dx$ $\therefore e^y = \frac{e^{2x}}{2} + \frac{x^3}{3} + c$	1 1 1

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5.	c)	<p>A particle starting with velocity 6 m/s has an acceleration $(1-t^2)m/s^2$. When does it first comes to rest? How far has it then travelled?</p> <p>We have</p> <p>Ans acceleration = $\frac{dv}{dt} = (1-t^2)$</p> <p>$\therefore dv = (1-t^2)dt$</p> <p>$\therefore \int dv = \int (1-t^2)dt$</p> <p>$\therefore v = t - \frac{t^3}{3} + c_1$</p> <p>At rest $t = 0, v = 6 \quad \therefore c_1 = 6$</p> <p>$\therefore v = t - \frac{t^3}{3} + 6$</p> <p>When particle first comes to rest, $v = 0$</p> <p>$\therefore 0 = t - \frac{t^3}{3} + 6$</p> <p>$\therefore 0 = 3t - t^3 + 18$</p> <p>$\therefore t = 3, \quad t^2 + 3t + 6 = 0$</p> <p>$\therefore$ Particle first time comes to rest at $t = 3$</p> <p>$v = \frac{dx}{dt} = t - \frac{t^3}{3} + 6$</p> <p>$\therefore dx = \left(t - \frac{t^3}{3} + 6 \right) dt$</p> <p>$\therefore \int dx = \int \left(t - \frac{t^3}{3} + 6 \right) dt$</p> <p>$\therefore x = \frac{t^2}{2} - \frac{t^4}{12} + 6t + c_2$</p> <p>at $t = 0, x = 0 \quad \therefore c_2 = 0$</p> <p>$\therefore x = \frac{t^2}{2} - \frac{t^4}{12} + 6t$</p> <p>at $t = 3$</p> <p>$\therefore x = \frac{(3)^2}{2} - \frac{(3)^4}{12} + 6(3)$</p> <p>$\therefore x = 15.75 \text{ m}$</p>	<p>06</p> <p>1/2</p> <p>1</p> <p>1/2</p> <p>1</p> <p>1/2</p> <p>1</p> <p>1/2</p> <p>1/2</p> <p>1/2</p>

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6.	a)(i)	<p>Attempt any <u>TWO</u> of the following: Attempt the following:</p> <p>Using Trapezoidal rule , calculate the approximate value of $\int_3^8 \log_e x$ by using following table.</p> <table border="1"> <tr> <td>x</td> <td>3</td> <td>4</td> <td>5</td> <td>6</td> <td>7</td> <td>8</td> </tr> <tr> <td>$y = \log_e x$</td> <td>1.098</td> <td>1.3863</td> <td>1.6094</td> <td>1.7918</td> <td>1.9458</td> <td>2.0794</td> </tr> </table> <p>Trapezoidal rule</p> $\int_a^b f(x) dx = \frac{h}{2} [(y_0 + y_n) + 2(y_1 + y_2 + \dots + y_{n-1})]$ <p>where $h = \frac{b-a}{n} = \frac{8-3}{5} = 1$</p> $\int_3^8 \log_e x = \frac{1}{2} [(1.098 + 2.0794) + 2(1.3863 + 1.6094 + 1.7918 + 1.9458)]$ $= \frac{1}{2} [3.1774 + 2(6.7333)]$ $= 8.322$	x	3	4	5	6	7	8	$y = \log_e x$	1.098	1.3863	1.6094	1.7918	1.9458	2.0794	<p>12 06 03</p> <p>1 1 1</p>
x	3	4	5	6	7	8											
$y = \log_e x$	1.098	1.3863	1.6094	1.7918	1.9458	2.0794											

OUR CENTERS :

KALYAN | DOMBIVLI | THANE | NERUL | DADAR

Contact - 9136008228



SUMMER- 2019 EXAMINATION

Subject Name: Applied Mathematics

Model Answer

Subject Code: 22201

Q. No.	Sub Q.N.	Answers	Marking Scheme												
6.	a)(ii)	Using Simpson's $\frac{1}{3}$ rule, calculate the approximate value of $\int_0^4 e^x dx$ by using following data:	03												
		<table border="1"> <thead> <tr> <th>x</th> <th>0</th> <th>1</th> <th>2</th> <th>3</th> <th>4</th> </tr> </thead> <tbody> <tr> <td>$y = e^x$</td> <td>1</td> <td>2.72</td> <td>7.39</td> <td>20.09</td> <td>54.60</td> </tr> </tbody> </table> <p>Ans Let $y = e^x$ $a = 0$, $b = 4$ and $n = 4$ $\therefore h = \frac{b-a}{n} = \frac{4-0}{4} = 1$ Using Simpson's $1/3^{rd}$ rule $\int_a^b f(x) dx = \frac{h}{3} [(y_0 + y_n) + 4(y_1 + y_3 + \dots) + 2(y_2 + y_4 + \dots)]$ $\int_0^4 e^x dx = \frac{1}{3} [(1 + 54.60) + 4(2.72 + 20.09) + 2(7.39)]$ $= 53.8733$</p>	x	0	1	2	3	4	$y = e^x$	1	2.72	7.39	20.09	54.60	1 1 1
x	0	1	2	3	4										
$y = e^x$	1	2.72	7.39	20.09	54.60										
	b)	Evaluate $\int_0^1 \frac{dx}{1+x^2}$ by Trapezoidal rule, taking $n = 4$. Hence, obtain approximate value of π .	06												
	Ans	Trapezoidal rule $\int_a^b f(x) dx = \frac{h}{2} [(y_0 + y_n) + 2(y_1 + y_2 + \dots + y_{n-1})]$ where $h = \frac{b-a}{n} = \frac{1-0}{4} = \frac{1}{4}$ or 0.25 <table border="1"> <thead> <tr> <th>x</th> <th>0</th> <th>0.25</th> <th>0.5</th> <th>0.75</th> <th>1</th> </tr> </thead> <tbody> <tr> <td>$y = f(x)$</td> <td>1</td> <td>0.9412</td> <td>0.8</td> <td>0.64</td> <td>0.5</td> </tr> </tbody> </table> $\int_0^1 \frac{dx}{1+x^2} = \frac{0.25}{2} [(1+0.5) + 2(0.9412 + 0.8 + 0.64)]$ $\therefore \int_0^1 \frac{dx}{1+x^2} = 0.7828$ ----- (1) $\int_0^1 \frac{dx}{1+x^2} = [\tan^{-1} x]_0^1 = \tan^{-1}(1) - \tan^{-1}(0) = \frac{\pi}{4}$ ----- (2) From (1) and (2) $\frac{\pi}{4} = 0.7828$ $\therefore \pi = 3.1312$	x	0	0.25	0.5	0.75	1	$y = f(x)$	1	0.9412	0.8	0.64	0.5	1 1 1 1 1
x	0	0.25	0.5	0.75	1										
$y = f(x)$	1	0.9412	0.8	0.64	0.5										

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6.	c)	Evaluate $\int_0^{\pi/2} \sqrt{\cos x} dx$ using Simpson's $\frac{3}{8}$ rule with $n = 8$	06																				
	Ans	$h = \frac{b-a}{n} = \frac{\frac{\pi}{2} - 0}{8} = \frac{\pi}{16}$ <table border="1"> <tr> <td>x</td> <td>0</td> <td>$\pi/16$</td> <td>$\pi/8$</td> <td>$3\pi/16$</td> <td>$\pi/4$</td> <td>$5\pi/16$</td> <td>$3\pi/8$</td> <td>$7\pi/16$</td> <td>$\pi/2$</td> </tr> <tr> <td>y</td> <td>1</td> <td>0.9903</td> <td>0.9612</td> <td>0.9118</td> <td>0.8409</td> <td>0.7454</td> <td>0.6186</td> <td>0.4417</td> <td>0</td> </tr> </table> <p>Using Simpson's $3/8^{\text{th}}$ rule.</p> $\int_a^b f(x) dx = \frac{3h}{8} [(y_0 + y_n) + 3(y_1 + y_2 + y_4 + y_5 + \dots) + 2(y_3 + y_6 + \dots)]$ $\therefore \int_0^{\pi/2} \sqrt{\cos x} dx = \frac{3(\pi/16)}{8} [(1+0) + 3(0.9903+0.9612+0.8409+0.7454+0.4417) + 2(0.9118+0.6186)]$ $\therefore \int_0^{\pi/2} \sqrt{\cos x} dx = 0.3749\pi = 1.178$	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	0.9612	0.9118	0.8409	0.7454	0.6186	0.4417	0	1 2 1 2
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	0.9612	0.9118	0.8409	0.7454	0.6186	0.4417	0														
		<p><u>Important Note</u></p> <p><i>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.</i></p>																					