All Branches Hinglish

Subject: Engineering Mathematics

DPP-03

Chapter: Numerical Methods

Topic : Numerical Integration & Solution of Differential equation

1. Consider an ordinary differential equation $\frac{dx}{dt} = 4t + 4$

If $x = x_0$, at $t = 0$, the increment in x calculated using Runge-Kutta fourth order multi-step method with a step size of $\Delta t = 0.2$ is

(a) 0.22 (b) 0.44

(c) 0.66 (d) 0.88

2. The ordinary differential equation $\frac{dx}{dt} = -3x + 2$, with $x(0) = 1$ is to be solved using the forward Euler method. The largest time step that can be used to solve the equation without making the numerical solution unstable is _____.

3. Consider the equation $\frac{du}{dt} = 3t^2 + 1$ with u = 1 at $t = 0$. This is numerically solved by using the forward Euler method with a step size, $\Delta t = 2$. The absolute error in the solution at the end of the first-time step is _____

4. Match the problem type Group-I with the numerical method in Group-2

Group-I		Group-II	
(P)	System of linear algebraic equations	(i)	Newton-Raphson
(Q)	Non-linear algebraic equations	(ii)	Gauss-seidel
(R)	Ordinary differential equations	(iii)	Simphson's Rule
(S)	Numerical integrations	(iv)	Runge-Kutta

Choose the correct set of combinations.

(a) P – II, Q – I, R – III, S – IV

(b) P – I, Q – II, R – IV, S – III

(c) P – IV, Q – III, R – II, S – I

(d) P – II, Q – I, R – IV, S – III

5. Consider a differential equation $\frac{dy(x)}{dx} - y(x) = x$ with the initial condition $y(0) = 0$. Using Euler's first order method with a step size of 0.1, the value of $y(0.3)$ is

(a) 0.01 (b) 0.031

(c) 0.0631 (d) 0.1

6. Match the CORRECT pairs

Numerical integration Scheme		Order of Fitting Polynomial	
P.	Simpson's 3/8 Rule	1.	First
Q.	Trapezoidal Rule	2.	Second
R.	Simpson's 1/3 Rule	3.	Third

(a) P – 2, Q – 1, R – 3

(b) P – 3, Q – 2, R – 1

(c) P – 1, Q – 2, R – 3

(d) P – 3, Q – 1, R – 2

7. The values of function $f(x)$ at 5 discrete points are given below.

x	0	0.1	0.2	0.3	0.4
$f(x)$	0	10	40	90	160

Using Trapezoidal rule with step size of 0.1 the value of $\int_0^{0.4} f(x)dx$ is _____.

8. The estimate of $\int_{0.5}^{1.5} \frac{dx}{x}$ obtained using Simpson's rule with three-point function evaluation exceeds the exact value by

(a) 0.235 (b) 0.068

(c) 0.024 (d) 0.012

9. A calculator has an accuracy up to 8 digits after decimal. The value of $\int_0^{2\pi} \sin x\,dx$ when evaluated using this calculator by trapezoidal method with 8 equal intervals, to 5 significant digits is

(a) 0.00000 (b) 1.0000

(c) 0.00500 (d) 0.00025

10. Evaluate $\int_0^6 \frac{dx}{1+x^2}$ by using Simpson's $\frac{3}{8}$ rule .

Answer Key

1. **(d)**
2. **(0.66)**
3. **(8)**
4. **(d)**
5. (b)
6. **(d)**
7. **(22)**
8. **(d)**
9. **(a)**
10. **(1.35708)**