

Which are true about interpolation?

- I. It is a process for finding a value between two points on a line or curve.  
 II. Interpolation provides a mean for estimating functions at the intermediate points.

- a) Only I  
 b) Only II  
 c) Both I & II  
 d) None of the above

- a) Option (a)  
 b) Option (b)  
 c) Option (c)  
 d) Option (d)

Answer: a

A Lagrange polynomial passes through three data points as given below

$x$	10	15	20
$f(x)$	19.45	10.63	7.82

The polynomial is determined as  $f(x) = L_0(x) \cdot (19.45) + L_1(x) \cdot (10.63) + L_2(x) \cdot (7.82)$

The value of  $f(x)$  at  $x = 12$  is

- a) 12.78  
 b) 13.08  
 c) 15.20  
 d) 11.36

Answer: c

To solve the ordinary differential equation

$$10 \frac{dy}{dx} + x^2 e^x = y \cos(x) + x \sin(y), y(0) = 5$$

using Runge-Kutta 4th order method, the equation is re-written as

- a)  $\frac{dy}{dx} = y \cos(x) + x \sin(y), y(0) = 5$   
 b)  $\frac{dy}{dx} = \frac{1}{10} (y \cos(x) + x \sin(y)), y(0) = 5$   
 c)  $\frac{dy}{dx} = \frac{1}{10} (y \cos(x) + x \sin(y) - x^2 e^x), y(0) = 5$   
 d)  $\frac{dy}{dx} = x \sin(y) - x^2 e^x, y(0) = 5$

- a) Option (a)  
 b) Option (b)  
 c) Option (c)  
 d) Option (d)

Answer: b

- a) 2.8634
- b) 2.5546
- c) 2.1865
- d) 1.9856

Given  $4\frac{dy}{dx} + x^2 = y^3$ ,  $y(0.5)=2$ , and using a step size of  $h = 0.2$ , Find the value of  $y(0.7)$  using Runge-Kutta 4<sup>th</sup> order method is

Answer: b

What will be the area under the curve using the Trapezoidal Rule

x	1.4	1.6	1.8	2.0	2.2
y	4.3215	4.7428	5.5205	6.0525	6.8762

- a) 4.3829
- b) 5.4863
- c) 6.3427
- d) 3.2857

Answer: d

The real root of the equation  $5x - 2\cos x - 1 = 0$  (up to two decimal accuracy) is

[You can use any method known to you. A range is given in output rather than single value to avoid approximation error]

- a) 0.45 to 0.47
- b) 0.47 to 0.49
- c) 0.41 to 0.43
- d) 0.53 to 0.56

Answer: d

The value of  $\int_0^3 x^2 e^{2x} dx$  by using one segment trapezoidal rule is

- a) 5446.3
- b) 5336.2
- c) 4986.5
- d) 5278.4

Answer: a

Which is/are false?

- I. The bisection method is guaranteed to work for finding roots of all continuous functions.
- II. Trapezoidal rule is a technique for approximating the indefinite integral.
- III. Lagrange polynomial is used for Polynomial Interpolation.

- a) Only I
- b) Only II
- c) II and III
- d) None of the above are false

Answer: b

Find the root of  $x^4 - x - 10 = 0$  approximately upto 5 iterations using Bisection Method. Let  $a = 1.5$  and  $b = 2$ .

- a) 1.68
- b) 1.92
- c) 1.86
- d) 1.66

Answer: c

Match the following

- A. Newton Method
- B. Lagrange Polynomial
- C. Trapezoidal Method
- D. RungeKutta Method

- 1. Integration
- 2. Root finding
- 3. Differential Equation
- 4. Interpolation

- a) A-2, B-4, C-1, D-3
- b) A-3, B-1, C-2, D-4
- c) A-1, B-4, C-3, D-2
- d) A-2, B-3, C-4, D-1

Answer: a