MS517 Model

Choose the correct answer

Q1: Use the **bisection method** to determine a solution of

$$f(x) = x^3 - 2x - 5 = 0 ,$$

if the root of equation lies between (2,3). Use only five iterations

1- the second iteration root is: x_2 =

a) 3 b) 2 c) 2.5 d) 2.25

2- the value of f(x_2)

a) 1.8096 b) 1.72643 c) 1.54784 d) 0.8467

3- the fourth iteration root is: x_4 =

a) 2.125 b) 2.75 c) 2.0625 d) 2.1093

4- the last iteration root $x_{5=}$

a) 2.0875 b) 2.075 c) 2.0525 d) 2.09375

5- the absolute error for iteration five is ε

a) 0.125 b) 0.0625 c) 0.03125 d) 0.02175

Q2: Use the **Newton's method** to determine a solution of

$$f(x) = x^4 - x - 10 = 0 ,$$

Correct up to 5-decimal places ($\varepsilon = 0.00001$) with initial values $x_0 = 2$

6- the first iteration root is: x_1 =

a) 2 b) 1 c) 1.87097 d) 1.9

7- the second iteration root is: x_2 =

a) 1.9324 b) 1.85578 c) 1.97097 d) 1.94527

8- the third iteration root is: x_3 =

a) 1.87324 b) 1.85578 c) 1.85559 d) 1.84527

9- the fourth iteration is x_4 =

a) 1.85558 b) 1.85578 c) 1.85559 d) 1.85552

10- the value of f(x_4)

a) 0.08572 b) 0.05587 c) 0.00482 d) 0.00001

11- the absolute error for iteration four is ε

a) 0.01519 b) 0.00019 c) 0.00001 d) 0.0004

12- the final root is

a) 1.87097 b) 1.85578 c) 1.85559 d) 1.85578

Q3: Based on the following table Use the **numerical differentiation** to find the first derivative

x	0.5	0.75	1	1.25
$f(x)$	1.05	1.75	2.05	2.50

13- using 2-points forward finite difference formula $f'(0.75)$ is

a) 1.2 b) 0.25 c) 0.30 d) 0.60

14- using 2-points backward finite difference formula $f'(0.75)$ is

a) 0.70 b) 2.8 c) 1.0 d) 0.25

15- using 2-points central finite difference formula $f'(0.75)$ is

a) 2.4 b) 2.5 c) 1.5 d) 4.0

16- using 3-points forward finite difference formula $f'(0.75)$ is

a) 0.4 b) 0.5 c) 0.9 d) 1.2

17- using 2-points backward finite difference formula $f'(1)$ is

a) 0.4 b) 0.5 c) 0.60 d) 8.0

Q4: Using numerical integration to Approximate the following integral

$$I = \int_0^1 \frac{1}{x^3+1}$$

18- using **midpoint method** the value of the I is

a) 0.5 b) 0.89 c) 0.66 d) 0.82

19- using **trapezoidal method** the value of the *I* is

a) 0.75 b) 0.5 c) 1.5 d) 1

20- using **Simpson 1/3 method** the value of the *I* is

a) 5.02 b) 0.48 c) 0.84 d) 0.175

ex

Approximate the integral

$$I = \int_0^1 \frac{1}{1+x^2}\,dx$$

by using the three methods of approximation

sol

1. mid point method

$$I_M = f\left(\frac{a+b}{2}\right)(b-a)$$

$$* \frac{a+b}{2} = \frac{0+1}{2} = 0.5$$

$$f(0.5) = \frac{1}{1+(0.5)^2}$$

$$I_M = \frac{1}{1+(0.5)^2}(1-0) = \frac{4}{5} = 0.8$$

2. Trapezoidal method

$$I_T = \left(\frac{b-a}{2}\right)[f(a) + f(b)]$$

$$= \left(\frac{1-0}{2}\right)\left[\frac{1}{1+(0)^2} + \frac{1}{1+(1)^2}\right] = \frac{3}{4} = 0.75$$

③ the simpson's method

$$I_S = \frac{h}{3}\left[f(a) + 4f\left(\frac{a+b}{2}\right) + f(b)\right]$$

$$h = \frac{b-a}{2} = \frac{1-0}{2} = 0.5$$

$$I_S = \frac{0.5}{3}\left[\frac{1}{1+(0)^2} + 4\cdot\frac{1}{1+(0.5)^2} + \frac{1}{1+(1)^2}\right]$$

$$= \frac{1}{6}\left[1 + \frac{16}{5} + \frac{1}{2}\right] = \frac{1}{6}\left[\frac{47}{10}\right] = 0.7833$$