ASSIGNMENT – 1

Solve manually the following problems:

1. Given $\frac{dy}{dx} = \frac{1}{x^2 + y}$, $y(4) = 4$, find $y(4.2)$ by Taylor's series method of order 2, taking h=0.1.

2. Solve $\frac{dy}{dx} = 3x + y^2$, y=1, when x = 0, numerically for x = 0.1 by Taylor's series method of order 2.

3. Solve the differential equation $\frac{dy}{dx} = 2y + 3e^x$ with $x_0 = 0, y_0 = 0$, using Taylor's series method of order 2 to obtain and check the value of y for x = 0.1, 0.2.

4. Given $\frac{dy}{dx} = y - x$,where $y(0)$ = 2, find $y(0.1)$ and $y(0.2)$ by Euler's method up to two decimal places.

5. Solve $y' = x - y^2$, ,by Euler's method for x =0.2 to 0.6 with h = 0.2 initially x = 0, y = 1.

6. Given that $\frac{dy}{dx} = x + y^2$,$y(0)$=1, find $y(0.2)$, by backward Euler's method.

7. Given $\frac{dy}{dx} = -\frac{y - x}{1 + x}$, with initial condition $y(0)$ = 1, find approximately y for x = 0.1, by backward Euler's method (two steps).

8. Use modified Euler's method with one step to find the value of y at x = 0.1 to five significant figures, where $\frac{dy}{dx} = x^2 + y$, y=0.94, when x = 0.

9. Using modified Euler's method, solve numerically the equation $\frac{dy}{dx} = x + |\sqrt{y}|$ with initial condition y = 1 at x = 0 for the range $0 \le x \le 0.4$ in steps of 0.2.

10. Use Runge-Kutta method of order 2 to solve $y' = xy$ for x = 1.4, initially x = 1, y = 2 (by taking step-length h = 0.2).

11. Solve the differential equation $\frac{dy}{dx} = \frac{1}{x + y}$ for x = 2.0 by fourth-order Runge-Kutta method, given that y(0)=1, interval length h = 0.5.

12. Use fourth-order Runge-Kutta method to solve $\frac{dy}{dx} = \frac{y^2 - x^2}{y^2 + x^2}$, 0.1, with y(0)=1 at x = 0.2, 0.4.

13. Using fourth-order Runge-Kutta method compute y(0.2), y(0.4) from $10\frac{dy}{dx} = x^2 + y^2$, 0.1, taking h=0.1.

Write computer code / use MATLAB software or any other software to solve the following problems: Also plot the solution curves.

1. Find $y(1)$ by Euler's method from the differential equation $\frac{dy}{dx} = \frac{-y}{1+x}$ when $y(0.3) = 2$. Convert up to four decimal places taking step length $h = 0.1$.

2. Given $\frac{dy}{dx} = x^2 + y$, with $y(0) = 1$, evaluate $y(0.02)$, $y(0.04)$ by backward Euler's method.

3. Find $y(4.4)$, by modified Euler's method taking $h = 0.2$ from the differential equation $\frac{dy}{dx} = \frac{2-y^2}{5x}$, given that y=1 when $x = 4$.

4. For the equation $\frac{dy}{dx} = 3x + \frac{y}{2}$, y(0)=1, find y at x=0.1, 0.2 with step-length 0.1, using mid-point method.

5. Use the Runge-Kutta method of order 2 to approximate y at $x = 0.1$ and $x = 0.2$ for the equation $\frac{dy}{dx} = x + y$.

6. Use implicit Runge-Kutta method with 2 slopes to calculate the value of y at $x = 0.1$, to five decimal places after a single step of 0.1, if $\frac{dy}{dx} = 0.31 + 0.25y + 0.3x^2$ and $y = 0.72$ when $x = 0$.

7. Find by implicit Runge-Kutta method with 2 slopes, an approximate value of y for x=0.8, given that y=0.41 when x=0.4 and $\frac{dy}{dx} = \sqrt{x+y}$. Take h=0.4.

8. Solve the equation $\frac{dy}{dx} = x - y^2, y(0) = 1$ for $x = 0.2$ and 0.4 to 4 decimal places by fourth-order Runge-Kutta method.

9. $\frac{dy}{dx} = -\frac{y^2 - 2x}{y^2 + x}$, use fourth-order Runge-Kutta method to find y at 0.1, 0.2, 0.3, 0.4, given that y=1 when x=0.

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