Tutorial II: Numerical solution of Ordinary Differential Equations

Note: All Notations and symbols have their usual meaning.

1. Use Euler method

   (a) $\frac{dy}{dx} = x + y$, $y(0) = 1$, take $h = 0.2$ and obtain $y(1)$, $y(0.4)$ and $y(0.6)$

   (b) $\frac{dy}{dx} + 2y = 0$, $y(0) = 1$, take $h = 0.1$ and obtain $y(0.1)$ and $y(0.2)$

   (c) $\frac{dy}{dx} = 1 + y^2$, $y(0) = 1$, take $h = 0.1$ and obtain $y(0.1)$ and $y(0.2)$

2. Find an approximate value of y when $x = 0.3$ given that $\frac{dy}{dx} = x^2 + y$, $y(0) = 1$.

3. Use the Runge-Kutta method to solve $10\frac{dy}{dx} = x^2 + y^2$, $y(0) = 1$ for the interval $0 < x \leq 0.4$ with $h = 0.1$.

4. Use the Runge-Kutta method to find the value of y when $x = 1$ given that $\frac{dy}{dx} = \frac{y-x}{y+x}$, $y(0) = 1$.

5. Solve $\frac{dy}{dx} = \frac{y^2-x^2}{y^2+x^2}$, $y(0) = 1$ at $x = 0.2, 0.4$ by using Runge-Kutta method of fourth order.

6. Find $y(0.2)$, $y(0.4)$ and $y(0.6)$ by using Runge-Kutta method of fourth order given that $\frac{dy}{dx} = 1+y^2$, $y(0) = 0$.

7. Use the Runge-kutta method to find y for $x = 0.1, 0.2, 0.3$ given that $\frac{dy}{dx} = xy + y^2$, $y(0) = 1$.

8. Find $y(0.1)$ and $y(0.2)$ correct to 4 decimal places given that $\frac{dy}{dx} = y - x$, $y(0) = 2$.