3. Runge-Kutta 3 method (1st order derivative) example (Enter your problem)

1. **Formula-1 & Example-1**
2. Example-2
3. Example-3
4. Formula-2 & Example-1
5. Example-2
6. Example-3

Other related methods

1. Euler method (1st order derivative)
2. Runge-Kutta 2 method (1st order derivative)
3. **Runge-Kutta 3 method (1st order derivative)**
4. Runge-Kutta 4 method (1st order derivative)
5. Improved Euler method (1st order derivative)
6. Modified Euler method (1st order derivative)
7. Taylor Series method (1st order derivative)
8. Euler method (2nd order derivative)
9. Runge-Kutta 2 method (2nd order derivative)
10. Runge-Kutta 3 method (2nd order derivative)
11. Runge-Kutta 4 method (2nd order derivative)

2. Runge-Kutta 2 method (1st order derivative)
(Previous method)

2. Example-2
(Next example)

1. Formula-1 & Example-1

Formula

3. Third order R-K method

$$k_1 = hf\left(x_0, y_0\right)$$

$$k_2 = hf\left(x_0 + \frac{h}{2}, y_0 + \frac{k_1}{2}\right)$$

$$k_3 = hf\left(x_0 + h, y_0 + 2k_2 - k_1\right)$$

$$y_1 = y_0 + \frac{1}{6}\left(k_1 + 4k_2 + k_3\right)$$

Examples

Given $y' = \frac{x - y}{2}, y(0) = 1, h = 0.1, y(0.2) = ?$

Third order R-K method

$k_1 = hf\left(x_0, y_0\right) = (0.1)f(0, 1) = (0.1) \cdot (- 0.5) = - 0.05$

$k_2 = hf\left(x_0 + \frac{h}{2}, y_0 + \frac{k_1}{2}\right) = (0.1)f(0.05, 0.975) = (0.1) \cdot (- 0.4625) = - 0.04625$

$k_3 = hf\left(x_0 + h, y_0 + 2k_2 - k_1\right) = (0.1)f(0.1, 0.9575) = (0.1) \cdot (- 0.42875) = - 0.04288$

$y_1 = y_0 + \frac{1}{6}\left(k_1 + 4k_2 + k_3\right)$

$y_1 = 1 + \frac{1}{6}[- 0.05 + 4(- 0.04625) + (- 0.04288)]$

$y_1 = 0.95369$

$\therefore y(0.1) = 0.95369$

Again taking $\left(x_1, y_1\right)$ in place of $\left(x_0, y_0\right)$ and repeat the process

$k_1 = hf\left(x_1, y_1\right) = (0.1)f(0.1, 0.95369) = (0.1) \cdot (- 0.42684) = - 0.04268$

$k_2 = hf\left(x_1 + \frac{h}{2}, y_1 + \frac{k_1}{2}\right) = (0.1)f(0.15, 0.93235) = (0.1) \cdot (- 0.39117) = - 0.03912$

$k_3 = hf\left(x_1 + h, y_1 + 2k_2 - k_1\right) = (0.1)f(0.2, 0.91814) = (0.1) \cdot (- 0.35907) = - 0.03591$

$y_2 = y_1 + \frac{1}{6}\left(k_1 + 4k_2 + k_3\right)$

$y_2 = 0.95369 + \frac{1}{6}[- 0.04268 + 4(- 0.03912) + (- 0.03591)]$

$y_2 = 0.91451$

$\therefore y(0.2) = 0.91451$

$\therefore y(0.2) = 0.91451$

This material is intended as a summary. Use your textbook for detail explanation.
Any bug, improvement, feedback then Submit Here

2. Runge-Kutta 2 method (1st order derivative)
(Previous method)

2. Example-2
(Next example)