Runge - kutta Methods

R.K methods for solving 1st order eqn:

2nd order R-K method

If the initial values of (x, y) for the diff equation $\frac{dy}{dx} = f(x, y)$, then the 1st increment in y namely Δy is calculated from the formula.

$$k_1 = hf(x, y)$$

$$k_2 = hf(x + h_2, y + k_1/2)$$

$$\Delta y = k_2 \quad \text{where } h = \Delta x$$

$$\therefore y(x+h) = y(x) + \Delta y$$

Third order R.k. method:

The algorithm for this method is given below.

$$k_1 = hf(x, y)$$

$$k_2 = hf(x + h/2, y + k_1/2)$$

$$k_3 = hf[x + h, y + 2k_2 - k_1]$$

& $$\Delta y = \frac{1}{6}[k_1 + 4k_2 + k_3]$$

$$\therefore y(x+h) = y(x) + \Delta y.$$

Fourth order R.k method for solving 1st order eqn

The algorithm for this method is given below

$$k_1 = hf(x, y)$$

$$k_2 = hf[x + h/2, y + k_1/2]$$

$$k_3 = hf[x + h/2, y + k_2/2]$$

$$k_4 = hf[x + h, y + k_3] \quad \& \quad \Delta y = \frac{1}{6}[k_1 + 2k_2 + 2k_3 + k$$

$$\therefore y(x+h) = y(x) + \Delta y.$$