

$$y' = 2y, \quad y(0) = 1 = U_0$$

PREDICTOR:  $U_{n+1}^0 = U_n + hf(U_n)$

CORRECTOR:  $U_{n+1}^{k+1} = U_n + \frac{h}{2}(f(U_n) + f(U_{n+1}^k))$

$$U_{n+1}^{k+1} = U_n + \frac{h}{2}(2U_n + 2U_{n+1}^k)$$

FOR  $k=0, n=0$ :

ONE CORRECTION  $U_1^1 = U_0 + \frac{h}{2}(2U_0 + 2U_1^0)$

$$U_1^0 = U_0 + h2U_0 = 1 + 2h$$

$$U_1^1 = 1 + \frac{h}{2}(2 + 2(1 + 2h))$$

TWO CORRECTIONS  $U_1^2 = U_0 + \frac{h}{2}(2U_0 + 2U_1^1)$

( $k=1, n=0$ )  $U_1^1 = U_0 + \frac{h}{2}(2U_0 + 2U_1^0) = 1 + \frac{h}{2}(2 + 2(1 + 2h))$

$$U_1^2 = 1 + \frac{h}{2}(2 + 2(1 + \frac{h}{2}(2 + 2(1 + 2h))))$$

Runge-Kutta 4th order method

$y' = f(x, y)$   
 $y(x_0) = y_0$   
 $h = x_1 - x_0$   
 $k_1 = f(x_0, y_0)$   
 $k_2 = f(x_0 + \frac{h}{2}, y_0 + \frac{h}{2}k_1)$   
 $k_3 = f(x_0 + \frac{h}{2}, y_0 + \frac{h}{2}(k_1 + k_2))$   
 $k_4 = f(x_0 + h, y_0 + h(k_1 + 2k_2 + k_3))$   
 $y_1 = y_0 + h(\frac{1}{6}k_1 + \frac{4}{6}k_2 + \frac{2}{6}k_3 + \frac{1}{6}k_4)$

Note: This is an example of 2 stage Runge-Kutta method.

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