Runge - Kutta (RK) Method

↳ Classical Method

↳ Like Newton Raphson

↳ On the backend of built-in function to calculate ODE, this one is implemented.

↓

ODE45() → In Matlab

↳ Give solution to 4th order

$$y_{n+1} = y_n + \frac{1}{6}\left[k_1 + 2(k_2 + k_3) + k_4\right]$$

↳ In some books "h/6" is used so then we not multiply "h" to calculate any "k"

$$k_1 = h f(x_n, y_n)$$

$$k_2 = h f\left(x_n + \frac{h}{2}, y_n + \frac{k_1}{2}\right)$$

$$k_3 = h f\left(x_n + \frac{h}{2}, y_n + \frac{k_2}{2}\right)$$

$$k_4 = h f(x_n + h, y_n + k_3)$$

So the basic thing in RK Method is to create function

$$\frac{dy}{dt} = t e^{3t} - 2y \quad = f(t, y)$$

$$K_1 = h\left[t_n e^{3t_n} - 2y_n\right]$$

$$K_2 = h\left[\left(t_n + \frac{h}{2}\right)e^{3(t_n + h/2)} - 2\left(y_n + \frac{K_1}{2}\right)\right]$$

$$K_3 = h\left[\left(t_n + \frac{h}{2}\right)e^{3(t_n + h/2)} - 2\left(y_n + \frac{K_2}{2}\right)\right]$$

$$K_4 = h\left[(t_n + h)e^{3(t_n + h)} - 2(y_n + K_3)\right]$$

In this method you have to calculate value of K_1, K_2, K_3, K_4 each time in order to calculate y's 1 value

Table:

n	t_n	y_n	K_1	K_2	K_3	K_4	y_{n+1}