$$U_{n+1} = U_n + \frac{h}{2}(k_1 + k_2) \qquad f(y) = \frac{dy}{dt}$$

$$k_1 = f(U_n)$$

$$k_2 = f(U_n + hk_1) = f(U_n + h f(U_n))$$

$$U_{n+1} = U_n + \frac{h}{2}\left(f(U_n) + f(U_n + hf(U_n))\right)$$

$$U_{n+1} = U_n + 2hU_n + 2h^2 U_n$$

$$U(h) = U_n + 2hU_n + 2h^2 U_n$$

$$U(h/2) = U_n + hU_n + \frac{h^2}{2} U_n$$

$$U(h) - 2U(h/2) = -U_n + (2h^2 - h^2)U_n = -U_n + h^2 U_n$$

$$-(U(h) - 2U(h/2)) = U_n - h^2 U_n = R_1$$