Lab 7
Runga-Kutta's Method

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1. Plot approximations using Runga-kutta's method

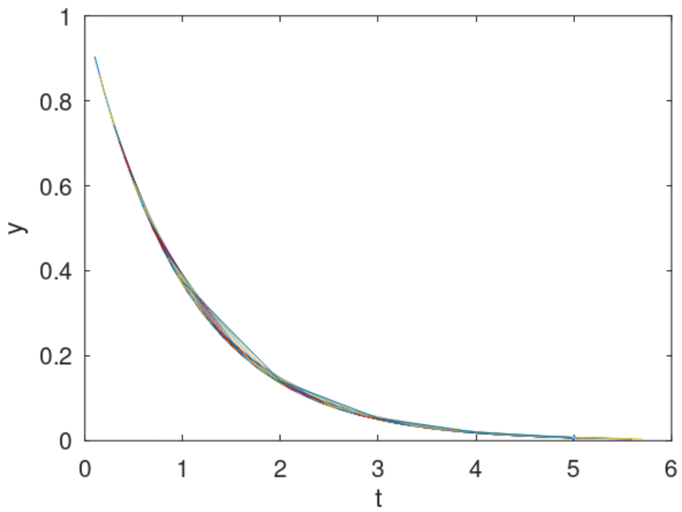

Figure 1: Approximations at $t_{final} = 5$

2. Plot the best fit line, log data and mean value, and state the slope (convergence rate).

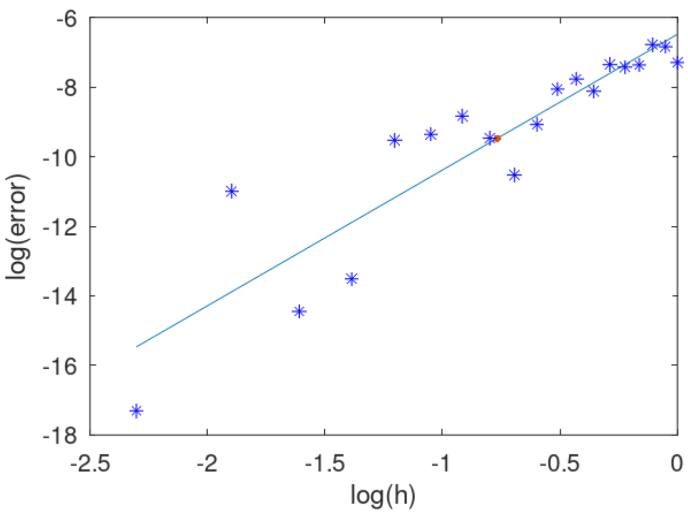

Figure 2: Log plot at $t_{final} = 5$

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>> paramter: min_step_size, increment_step_size, max_step_size, t_final

>> ests = w_runga_kutta(0.1,0.05,1,8)
convergence_rate = 3.9355

>> ests = w_runga_kutta(0.1,0.05,1,7)
convergence_rate = 3.9584

>> ests = w_runga_kutta(0.1,0.05,1,6)
convergence_rate = 4.6595

>> ests = w_runga_kutta(0.1,0.05,1,5)
convergence_rate = 3.9007

>> ests = w_runga_kutta(0.1,0.05,1,4)
convergence_rate = 3.9204

>> ests = w_runga_kutta(0.1,0.05,1,3)
convergence_rate = 4.7727

>> ests = w_runga_kutta(0.1,0.05,1,2)
convergence_rate = 4.0266
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3. Explain why taking logs and computing the slope gives the convergence rate.

We assume $e = \alpha(h)^r$ where e is an error, h is a time step, r is a convergenct rate and α is a constant. Then $\log e = r \log h + \log \alpha$. So r is the slope in the plot of $\log e$ and $\log h$.