Numerical Analysis
Finite and Shooting Methods

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1. Use finite-differences to approximate solutions to the linear BVP for $n = 9, 19, 39$

$$\begin{aligned} y'' &= 3y - 2y' \\ y(0) &= e^3 \\ y(1) &= 1. \end{aligned}$$

   Plot the approximate solution together with the exact solution $y(t) = e^{3-3t}$ in one figure. Use built-in Matlab solver for the linear system. Display the error as a function of t in a separate plot.

2. Apply shooting method to the nonlinear system of BVP

$$\begin{aligned} y_1' &= y_1 - 3y_1y_2 \\ y_2' &= -6(ty_2 + \ln y_1) \\ y_1(0) &= 1 \\ y_2(1) &= -\frac{2}{3}. \end{aligned}$$

   Plot the solution together with the boundary conditions. Use Matlab solver to solve the nonlinear equation.