Mathematics 5410 Chaos and Euler's Method

The Project: For the initial value problem

$$y' = y(1 - y), \quad y(0) = 1.3,$$

solve numerically by Euler's numerical method

$$y_0 = 1.3, \quad y_{n+1} = y_n + h(1 - y_n)y_n,$$

for the given values of h. Plot the solutions and try to reproduce the figures of Section 2.7 in Borrelli–Coleman.

 $\begin{aligned} h &= 1.65 & \text{Figure } 2.7.1 \\ h &= 2.1 & \text{Figure } 2.7.2 \\ h &= 2.5 & \text{Figure } 2.7.3 \\ h &= 2.56 & \text{Figure } 2.7.4 \end{aligned}$

The plots package in maple is useful. Most of this project can be accomplished directly with plot in mapleV4, using plot option style=POINT.

The exact solution for the given initial value problem is

$$y(t) = \frac{1}{1 - .2307692308e^{-t}}.$$

This solution is obtained from the general solution

$$y(t) = \frac{1}{1 - e^{-t} \frac{-1 + y_0}{y_0}}$$

by setting $y_0 = 1.3$.