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 $y_0 = 1.3$.