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.

- \( h = 1.65 \)  \( \text{Figure 2.7.1} \)
- \( h = 2.1 \)  \( \text{Figure 2.7.2} \)
- \( h = 2.5 \)  \( \text{Figure 2.7.3} \)
- \( h = 2.56 \)  \( \text{Figure 2.7.4} \)

The \texttt{plots} package in \texttt{maple} is useful. Most of this project can be accomplished directly with \texttt{plot} in \texttt{mapleV4}, using plot option \texttt{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 \( y_0 = 1.3 \).