# 1 Coding first order ordinary differential equation

## 1.1 Problem

Code a program in C++ to solve the simple ordinary differential equation:

$$\frac{dy}{dt} = -y \tag{1}$$

for time 0 to 2 seconds.

## 1.2 Analytical solution

The analytical solution for this equation is

$$y = Ce^{-t} \quad , \tag{2}$$

where, for simplicity, it may be assumed that $C = 1$ based on the initial condition $y(t = 0) = 1$.

## 1.3 Numerical approach

Using the discrete finite difference approximation, the derivative may be represented as

$$\frac{dy}{dt} = \frac{y^{n+1} - y^n}{\Delta t} \quad . \tag{3}$$