Assignment 10
Deadline = Tuesday of Week 11

Please submit written solutions in lectures, and email me your Maple file, 'assignment10<name>.mw', by Tuesday of Week 11.

Q1. Solve the initial value problem, with $h = 0.125$,

$$\frac{dy}{dx} = ye^{-3x} - y^2, \qquad\qquad y(0) = 1$$

using both the explicit and implicit Euler method to find $y(0.25)$. Compare the two absolute errors, taking $y(0.25) = 0.9342$ as the exact value. Check your answer with Maple. How does the error in the explicit method depend on the choice of h? To test this, decrease h in the maple file. For example, try dividing h by 2 and by 4, and see how the error varies with h.

Q2. Solve the initial value problem, with $h = 0.2$,

$$\frac{dx}{dt} = -20(x - t) + 1, \qquad\qquad x(0) = 2$$

using both the explicit and implicit Euler method to find $x(0.4)$. Compare the two absolute errors, given that the exact solution is $x(t) = t + 2e^{-20t}$. Which method is better? Why?

Q3. Solve the initial value problem, with $h = 0.1$,

$$\frac{dy}{dx} = \sin y + x, \qquad\qquad y(0) = 1$$

using the implicit Euler method combined with the Newton-Raphson method (take no more than 3 steps of the N-R method at each step of the implicit Euler method) to calculate $y(0.2)$. Check your answer with Maple.