NEEP 602 -- Engineering Problem Solving II
Spring 2005
Exercise 0

Using Euler's Method in Microsoft Excel

Here we will begin by using Excel functions to solve an initial value problem. A simple, single step method is that of Euler. Given a first-order ordinary differential equation and an initial value for the unknown function *y(t)*, we need to generate values of the dependent variable for a series of successive equally-spaced values of the independent variable. Thus, we'll need two functions: one that defines the derivative *y'(t)* (the right-hand side of our differential equation), and one that will calculate successive values of *y* at each step. We can then simply call this function repeatedly in our spreadsheet to generate an approximate solution to our ODE. To solve the differential equation

$$dy/dt=2yt$$

with initial condition

$$y(0) = 1$$

the two functions we need are

```
Function f(t, y)
    f = 2 * y * t
End Function

Function Eu(t, y, h)
     Eu = y + h*f(t,y)
End Function
```

In the spreadsheet, we simply place the initial values for *t* and *y*, choose a time step, and make repeated calls to this function (Eu) to produce our solution. A typical sheet would look like the following (showing formulas here, rather than the results of the calculation):

	A	**B**
1	h	0.1
2		
3	**t**	**y**
4	0	1
5	=A4+B$1	=Eu(A4,B4,B$1)
6	=A5+B$1	=Eu(A5,B5,B$1)

It is interesting to compare these results with the exact, or analytical solution, $y = e^{t^2}$. Draw a graph to illustrate the differences. What happens if you decrease the step size? Add columns to calculate the absolute and relative errors in the two solutions.