

## MAT 333 SECTIONS 001 AND 002 SPRING 2001

You will copy, create and execute Matlab files which use Euler's method to solve the differential equation

$$\frac{dy}{dx} = f(x, y) \quad y(x_0) = y_0, \quad (1)$$

where

$$x_0 \leq x \leq x_n \quad \text{and} \quad x_n = x_0 + nh.$$

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In the computer lab, MG104:

1. Logon.
2. Click *xterm* in the upper left corner.
3. Copy *myeuler.m* to your account by typing:

```
cp /home/public/mead/myeuler.m .
```

4. Create a file *f.m* by typing

```
pico f.m
```

- (a) Follow the menu at the bottom of the screen and input the following two lines exactly

```
function yp=f(x,y)
yp=-2*x*y^2;
```

- (b) exit and save.

5. Create a file *fexact.m* by typing

```
pico fexact.m
```

- (a) Follow the menu at the bottom of the screen and input the following two lines exactly

```
function yexact=fexact(x,y)
yexact=1/(1+x^2);
```

- (b) exit and save.

6. Type *matlab* (you should get a `>>` prompt).

7. Type *myeuler(0,1,2,4)*;

What did you just do? First, in file *f.m* you inputed a function  $f(x, y)$  defined by the differential equation (1). Then, in *fexact.m* you inputed the exact solution  $y$ . Lastly, you called the program *myeuler* to compute the solution  $y(x)$  of (1), with  $x_0 = 0$ ,  $y_0 = 1$ ,  $x_n = 2$  and  $n = 4$ . A table containing the computed solution, the exact solution, and the error is in the file *table.txt* (type `!pico table.txt` to read it), and you should see a picture of the computed solution and exact solution in a separate window. Now try some of your homework problems by inputing different functions  $f(x, y)$ , their exact solutions  $y$ , along with appropriate initial conditions  $x_0, y_0$ , final  $x_n$  and number of steps  $n$ . Recall that  $h = (x_n - x_0)/n$ .

8. To input a new function  $f(x, y)$  and new solution  $y$ , in *matlab*, type `!pico f.m` and `!pico fexact.m`. (If you are not in *matlab*, you do not need to type `!` first)
9. To compute the solution with different initial conditions, or different  $n$ , in *matlab* type `myeuler(x0, y0, xn, n)`; with appropriate values of  $x_0, y_0, x_n$ , and  $n$
10. To exit *matlab*, type *exit*.