

MAPLE ASSIGNMENT 4,

MATH 266

I shall now use MAPLE to numerically solve the initial value problem,

$$\frac{dy}{dx} = x^2 + y^2$$

$$y(0) = 0$$

I shall use the basic Euler Method. First, I define a function $f(x,y)$ of two variables:

```
> f := (x,y) -> x^2 + y^2 ;
```

$$f := (x, y) \rightarrow x^2 + y^2$$

```
> h := .1: # This is the step size.
```

```
> x[0] := 0: # Define initial x value.
```

```
> y[0] := 0: # Define initial y value.
```

```
> for n from 0 to 9 # Push shift-return on a SUN or PC (<return> on a Mac).
do # use shift-return until last line
x[ n+1 ] := evalf( x[ n ] + h ) :
y[ n+1 ] := evalf( y[ n ] + h * f( x[n], y[n] ) ) :
od: # Push <return> on a SUN, <enter> on a Mac.
```

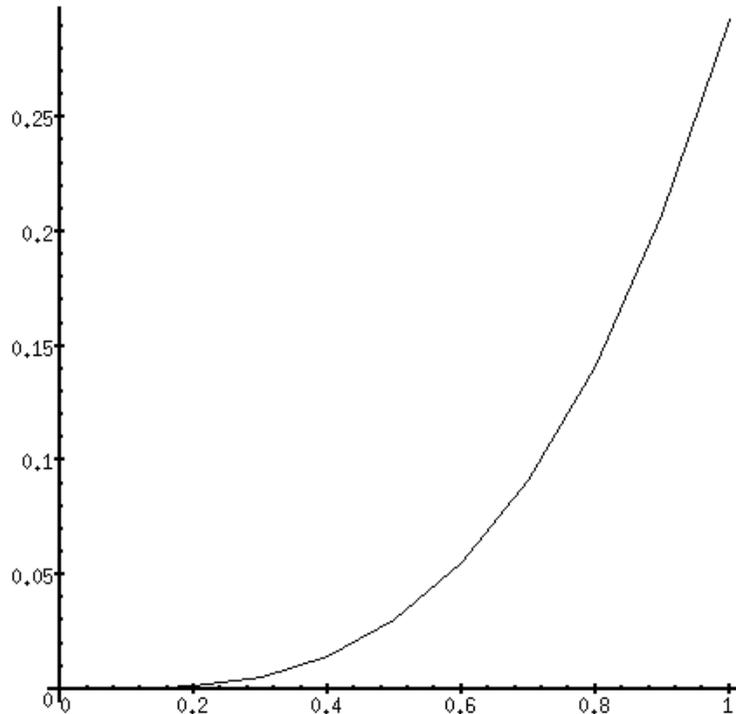
The five lines above get executed as a single command when I push <return> (<enter> on a Mac). I pushed shift-return (<return> on a Mac) at the end of the first four lines. Colons at the end of a line suppress output at run time. Semi-colons cause output.

```
> printf('n | x[n] | y[n]\n');
printf('-----\n');
for n from 0 to 10
do
printf('%-2.0f | %-3.1f | %-g\n',n,x[ n],y[ n] );
od;
```

n	x[n]	y[n]
0	0.0	0
1	0.1	0
2	0.2	0.001
3	0.3	0.0050001
4	0.4	0.0140026
5	0.5	0.0300222
6	0.6	0.0551123
7	0.7	0.0914161
8	0.8	0.141252
9	0.9	0.207247
10	1.0	0.292542

```
> points := [ seq( [ x[n], y[n] ], n=0..10 ) ] : #End with a : to suppress output.  
> plot(points, title='Euler method with h=0.1');  
>
```

Euler method with h=0.1



The assignment is this. Use MAPLE to do the following problems from the book:

- p. 392 / 11ab
- p. 404 / 11abc
- p. 409 / 11abc

Make only one plot of your favorite approximate solution.

REMARKS:

`evalf()` evaluates to be the floating point real number form of its argument. If you don't use `evalf`, you run the risk of having MAPLE try to keep track of a huge symbolic mess. `printf()` is a formatted print statement. See also `print()` for quick and easy printing. It is easy to accidentally push <return> when you needed to push shift-return. If you do this, MAPLE might get jammed and quit working. Typing `end;` at a MAPLE prompt usually jolts MAPLE back into input mode. Save your work to a file often. If the MAPLE computation engine is declared dead, you will need to quit MAPLE and close the window and start over again from scratch. See pages 132-141 of the MAPLE Flight Manual for more information.