MATH 163, Spring 2001 **Due Date:**_____ **Name(s):** _____

Extra Project 3.1: Graphing a Function Using a Table

Objective

To review the graphing of functions by plotting points and "connecting the dots", and to investigate the connection between f and f' as functions.

Narrative

Since $f'(x) = \lim_{h\to 0} \dfrac{f(x+h)-f(x)}{h}$, it follows that for small values of h,

$$f'(x) \approx \frac{f(x+h)-f(x)}{h}. \qquad (*)$$

Task

a) Type the command lines below into Maple in the order in which they are listed. These command lines produce a table of values for $f(x) = (1-x^2)/(1+x^2)$ and $f'(x)$, $x \in [-2, 2]$

```
> # Project 3.1:  Graphing a Function Using a Table
> restart;
> f := x -> (1-x^2)/(1+x^2);
> f1 := D(f);
> a := -2.0; b := 2.0; N := 10; dx := (b-a)/N;
> M := matrix(N+1,3,(Row,Col)->0):
> M[1,1] := ´x´; M[1,2] := ´f(x)´; M[1,3] := ´f1(x)´;
> Digits := 2;
> for i from 1 to N do
    x := a + (i-1)*dx:
    M[i+1,1] := x:  M[i+1,2] := f(x):  M[i+1,3] := f1(x):  od:
> eval(M);
```

b) Continue by typing the following command lines into Maple. These command lines produce an empty graph (on which you will be asked to graph f and f').

```
> x := ´x´;
> plot(0,x=a..b,y=-1..1);
```

At this time make a hard-copy of your typed input and Maple's responses. Then, ...

c) on the graphic you produced in part (b), use the data you produced in part (a) to graph f and f' by hand, each in a different color, and label each graph. (Draw the graphs of f and f' by plotting points and "connecting the dots".)

d) Illustrate (*) by using the table of values you produced in part (a) to:

1. approximate $f'(1)$ (you'll be using values in the *second* column of the table in part (a) to do this), and
2. compute the absolute value of the difference between this approximation and the actual value of $f'(1)$ (which you can obtain from the *third* column of the table in part (a)). This is the *error* in the approximation.