Bob Gardner's Quick Guide to the Use of the TI-89 Calculator in Calculus 1

INTRODUCTION

The TI-89 graphing calculator is **very** versatile! This "quick guide" discusses a few commands that will be useful in Calculus 1 applications of the calculator. Since the calculator is so versatile, you may need to refer to the *TI-89 Guidebook* for details on specific settings of your calculator (such as the AUTO/EXACT/APPROX modes). The page numbers mentioned below all refer to the *Guidebook*.

You can get to the home screen from most locations just by pressing the HOME key. You can clear the home screen by pressing F1 8. You can set the calculator in radians mode by pressing

MODE ▽ ▽ ▽ ▷ 1.

To display a decimal approximation or representation of a precise number, press ◇ ENTER (for example, if the calculator is in EXACT mode then it displays $1 \div 3$ as $1/3$, but if you evaluate $1 \div 3$ by pressing ◇ ENTER the calculator returns .333333). The text editor can be accessed by pressing APPS 8. To determine the number of digits displayed in approximations, press MODE ▽ ▽ ▷, select the number of digits you desire, and hit ENTER ENTER. To choose between AUTO, EXACT, and APPROXIMATE, press MODE followed by ▽ 10 times (see page 22)

EVALUATING LIMITS

The syntax for evaluating $\lim_{x \to a} f(x)$ is

```
limit( f(x), x, a).
```

To access this operation press F3 3 (this displays "limit("), enter the function f, press ,, enter the variable you are using (probably X), press ,, enter the value which the variable approaches, and press). Hit ENTER and the limit is evaluated (see page 64).

Example 1. To see that $\lim_{x \to 0} \dfrac{\sin x}{x} = 1$, perform these keystrokes:

F3 3 2nd sin X) ÷ X , X , 0) ENTER.

The result is then displayed in "pretty print" (if turned on).

CALCULATING DERIVATIVES

The syntax for evaluating the derivative of $f(x)$ is:

`d( f(x), x)` or `d( f(x), x, 1)`.

You can calculate higher order derivatives as:

`d( f(x), x, n)`

for the nth derivative. To access this operation for the first derivative of f, press F3 1 (this displays "d("), enter the function f, press ,, enter the variable (probably X), and press). Hit ENTER and the limit is evaluated (see page 64).

Example 2. To see that the derivative of $\tan x$ is $\sec^2 x = \dfrac{1}{\cos^2 x}$, perform the keystrokes:

F3 1 2nd tan X) , X) ENTER.

Again, the result is presented in pretty print.

GRAPHING

See Chapter 6 of the *Guidebook* for a detailed explanation of the TI-89's graphing ability.

First, we enter the function to be graphed. This can be done by pressing either ◇ Y= or APPS 2. Then enter a function to be graphed as one of the subscripted y's. Next, select (or deselect) the function(s) to be graphed by placing a $\surd$ next to the desired function(s) using F4 to toggle the $\surd$. Then to graph the function(s) press ◇ GRAPH.

Example 3. To graph $\cos x$ perform these keystrokes (assuming there are no other functions in the Y= Editor already):

◇ Y= 2nd cos X) ENTER ◇ GRAPH.

You can adjust the "window" (i.e. the range of x and y values over which the function is displayed) by pressing ◇ WINDOW and adjusting as you desire. From the displayed graph, two convenient functions are ZOOM and TRACE (accessed by pressing F2 and F3 respectively — see pages 105–109 for details).

EVALUATING ANTIDERIVATIVES

The syntax for finding an antiderivative of a function f is

$$\int(\ \texttt{f(x), x}).$$

To access this operation, press F3 2 (this displays "$\int($"), enter f, press ,, enter the variable of the function (probably X), and press). Hit ENTER and an antiderivative is displayed (if the calculator can find one — if it cannot, it just displays the symbols for the indefinite integral).

Example 4. To see that an antiderivative of $1/x$ is $\ln|x|$, perform these keystrokes:

F3 2 1 ÷ X , X) ENTER.

EVALUATING DEFINITE INTEGRALS

The syntax for evaluating $\displaystyle\int_1^b f(x)\,dx$ is

$$\int(\ \texttt{f(x), x, a, b}).$$

To access this operation, press F3 2, enter f, press ,, enter the variable (probably X), press ,, enter a, enter b, and press). Hit ENTER and the result is displayed if the calculator can find an exact value and is in EXACT mode. If the calculator cannot find an exact value, then you can get a numerical approximation by hitting ◇ ENTER (or just ENTER if the calculator is in AUTO or APPROX mode).

Example 5. To see that $\displaystyle\int_0^1 x^2\,dx = \frac{1}{3}$, perform these keystrokes:

F3 2 X ∧ 2 , X , 0 , 1) ENTER.

Example 6. To approximate $\displaystyle\int_0^1 2^{x^2}\,dx$, perform these keystrokes:

F3 2 2 ∧ (X ∧ 2) , X , 0 , 1).

If the calculator is in EXACT mode and you press ENTER, then the calculator will just give you the question in pretty print. You can press ◇ ENTER to get a numerical approximation. Or, if the calculator is in AUTO or APPROX mode you can just hit ENTER. In either case, you get the numerical value 1.28823.