Calculus I Calculations on the TI-89

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This instruction sheet contains the types of calculations used in most Calculus I courses. For instructions on how to do some of these computations with the graph of a function, refer to the sheet Calculations with Graphs on the web site above.

**Numeric vs Algebraic:** The TI-89 is the only calculator in the TI family that can do Mathematics algebraically, which is how you do Math. For example, saying that for \( f(x) = x^2 \), \( f'(x) = 2x \) is taking a derivative algebraically. Most calculators will only find derivatives numerically, that is, for \( f(x) = x^2 \) it can tell you that \( f'(2) = 4 \) but not \( f'(x) = 2x \). The TI-89 can do both.

The Calculus commands can all be found under the Calc menu by pressing \( \text{F}3 \).

**Derivatives:** To evaluate an algebraic derivative select 1:df from the Calc menu. The form of the entry is \( df(x), x \). For a numerical derivative the form of the entry is \( df(f(x), x)l=a \). Screen 1 shows finding \( f'(x) \) and \( f'(2) \) for \( f(x) = x^2 \). Higher order derivatives can be found by entering \( df(f(x), x, \text{order}) \). Screen 2 shows how finding \( f''(x) \) and \( f''(2) \) for \( f(x) = x^3 \). You can also evaluate a derivative at a list of points. For example, \( d(x^2, x) \mid x = \{0, 1, 2, 3\} \) will evaluate \( f'(0), f'(1), f'(2), \) and \( f'(3) \).

**Integrals:** To evaluate an indefinite integral, select 2: \( f(x) \) from the Calc menu. The form of the entry to evaluate \( \int f(x) \, dx \) is \( \int (f(x), x) \). To evaluate a definite integral, the form of the entry \( \int (f(x), x, \text{lower limit}, \text{upper limit}) \). For example, to evaluate \( \int_0^3 x^2 + 1 \, dx \) enter \( \int (x^2 + 1, x, 0, 3) \) and press \( \text{ENTER} \) to get 12. Please note, for definite integrals the calculator does NOT give you the +C, you must add that.

**Limits:** To evaluate \( \lim_{x \to a} f(x) \) select 3:limit( from the Calc menu. The form of the entry is limit(f(x), x, a)

**fMin, fMax:** These will give you the x value of the minimum and maximum of a function. The form of entry for fMin is \( f\text{Min}(f(x), x) \), fMax is similar. The calculator will only find one value so check the graph to see if there is more than one minimum or maximum.

**arcLen:** Will evaluate the arc length of a function over a specified interval. The form of entry is arcLen(f(x), x, a, b) where a and b are the limits of the arc. For example to find the arc length of \( f(x) = x^2 + 1 \) between 0 and 3 enter arcLen(x^2+1, x, 0, 3) and press \( \text{ENTER} \) to get 9.747.

**Tables:** The Table will evaluate the y-coordinate of every function in the Y= editor. For example, enter \( f(x) = x^2 + 1 \) as y1 press [2nd][ALPHA][Y]. For Table settings, if Indpnt is set at ASK you will enter the x values by hand, if Indpnt is set at AUTO then the calculator will create a list of x values starting at the TblStart value and increasing by Delta Tbl. Screen 1 shows how to enter the function \( f(x) = x^2 + 1 \) and its derivative. Screen 2 shows the values of \( f(x) \) and its derivative for the values starting at x = 0 and increasing 0.5 each time.

**Notes**
The function in any of these commands can be called from the Y = editor (where functions are entered for graphing). For example, if \( y1 = x^2 + 3x - 1 \) and you need \( f''(x) \) you can enter df(y1, x). To type lower case y (which is different than Y), press [2nd][ALPHA][Y].