

Toolkit for the TI-85 and the TI-83

GETTING STARTED

The bottom cover has a battery cage. Open the cage cover by pressing the horizontal finger in the middle toward the cage cover and then lifting the cage cover. Insert 4 alkaline batteries with labels nearest the bottom of the calculator arranged from left to right: $- + - +$. Then snap the cage cover back on again.

Turn the calculator right side up. Open by sliding the upper cover away from you.

To turn on: press **ON** (bottom left). To turn off: press **2nd ON**

After approximately 5 minutes without activity, the calculator automatically turns off, remembering what is on the screen and function equations.

To increase screen contrast, press **2nd ↑** To decrease contrast, press **2nd ↓**

Symbols at the upper left of the buttons are accessed by pressing **2nd** and then the appropriate key: Thus $\sqrt{3}$ is obtained by pressing **2nd x^2 3** and π is obtained by pressing **2nd \wedge**

Symbols at the upper right of the buttons are “alphabetical,” and are accessed by pressing **ALPHA** and then the appropriate key. Thus **M** is obtained by pressing **ALPHA 8**

In the beginning you should check that the calculator is reset to its factory settings.

On the TI-85, press **2nd +** to access the reset menu, then press **F3** (for **RESET**).

On the TI-86, press **2nd 3 F3 F2**

To go to the home screen, press **2nd EXIT** To go back one menu, press **EXIT**

You can also turn off the calculator: **2nd ON**

You can recall and edit the previous expression by pressing **2nd ENTER**

↑ sends the cursor up one line; **→** sends the cursor to the right one character; similarly for **←** and **↓**.

Pressing **DEL** deletes a character:

To delete 9 in 123945, press **←** until the cursor is over 9, and press **DEL**.

Pressing **2nd DEL** inserts a character:

To insert 3 midway in 1245, press **←** until the cursor is over 4, and press **2nd DEL 3**

The **x-VAR** button is the variable x in an expression like $x^2 - 2x + 4$.

ENTERING MATHEMATICAL EXPRESSIONS

For -3 : press **(-) 3** (note that **(-)** toggles plus or minus sign; **-** is for subtraction)

For x^2 : press **x-VAR x^2** (alternatively, press **x-VAR \wedge 2**)

For $x^{2/3}$: press **x-VAR (2 \div 5)**

For $1/x$: press **1 \div x-VAR**

For $\sqrt{x-5}$: press **2nd x^2 (x-VAR - 5)** (note $\sqrt{x-5}$ is not $\sqrt{x} - 5$)

For $|4-x|$: On the TI-85 press **2nd CUSTOM ENTER (4 - x-VAR)**

On the TI-86 press **2nd \times F1 F5** (The \times is the multiplication key)

For $\sin \pi^4$: press **SIN (2nd \wedge \wedge 4)** (this is $\sin(\pi^4)$, not $(\sin \pi)^4$)

For e^{3x} : press **2nd LN (3 x-VAR)**

For $\frac{x\sqrt{x-1}}{x^2+1}$: press **(x-VAR 2nd x^2 x-VAR - 1) \div (x-VAR x^2 + 1)**

To find the value of any expression at, say, $x = 2$, you can either press **2** instead of **x-VAR** as you enter the expression, or you can press **2 STO x-VAR ENTER** before entering the expression.

In Math 140-141, have angles set to **RADIANS** (To find out if they are, press **MODE**. If on the third line **DEG** is shaded, press **↓ ↓ ← ENTER** so that **Radian** is shaded.)

ENTERING FUNCTIONS

To enter a function, press **GRAPH F1** (for $y1=$) and then the expression:

for $f(x) = x^2$, press **x-VAR x^2 ENTER** (the top line reads $y1 = x^2$).

If there was an expression already in $y1$, you can erase it by **CLEAR**.

To access $y2$, either press **ENTER** or press \downarrow .

To find iterates of a number such as .3 for $f(x) = x - x^2$, do the following:

.3 STO x-VAR ENTER x-VAR - x-VAR x^2 (this is $x - x^2$) STO x-VAR

Press **ENTER ENTER** etc. to obtain the successive iterates.

GRAPHING FUNCTIONS and ZOOMING IN

To graph a function like $x^3 - 2x - 2$, press **GRAPH F1**, key in **x-VAR \wedge 3 - 2 x-VAR - 2**, and then **2nd F5**. If you wish the standard viewing window of -10 to 10 on each axis, press

GRAPH F3 (that is, zoom) **F4** (that is, ZSTD, which stands for standard zoom) **ENTER**

Notice that $f(c) = 0$ for a value of c near to 1.7. To find a good approximation for c , we will zoom in. First press **GRAPH F4** (that is, trace), and then repeatedly press \rightarrow or \leftarrow until the cursor is nearest to the x axis (as you can tell by the numbers at the bottom of the screen). Starting with the standard viewing window, we obtain

$$x = 1.746031746 \quad y = -.1690642162$$

Then press **ENTER F3** (which says zoom) **F2** (which says zin for zoom in) **ENTER**

To obtain a better estimate, repeat the process:

GRAPH F4 \rightarrow or \leftarrow (repeatedly) ENTER F3 F2 ENTER

In our case we obtain $x = 1.7619047619$ $y = -.0543137893$

CAUTION: The coordinates exhibited at the bottom of the screen are only approximate. It is not accurate to say that $c = 1.7619047619$.

FOR LATER USE (at the end of Chapter 2): If we use the \rightarrow button and find two successive points "on" the graph such that the y values are of opposite sign, and if the function is continuous, then we know that c lies in the corresponding interval on the x axis (by the Intermediate Value Theorem). In our example above, two successive iterates of the \rightarrow button yield

$$x = 1.7619047619 \quad y = -.00583138793 \quad \text{and} \quad x = 1.7777777778 \quad y = .06310013697$$

The y values have different signs, so that c lies in the interval $(1.7619047619, 1.7777777778)$.

NUMERICAL DERIVATIVE: Press **2nd \div F2** to access nDer(. There are three components:

nDer(function, variable, number at which the derivative is to be evaluated). For the desired accuracy, on the TI-85, press **2nd CLEAR** and set **tol=** (which is the tolerance) to the desired accuracy. On the TI-86, press **2nd 3 F4**. The default is **1E-5** (that is, .00001). For example, suppose we wish to find the derivative of x^3 at 2.6. Then we would do the following: **nDer(x^3 , x ,2.6)**. The answer appears as 20.280001.

NUMERICAL INTEGRAL: Press **2nd \div F5** to access fnInt(. There are four components:

fnInt(function, variable, lower limit of integration, upper limit of integration). For example, suppose we wish to find the integral of $1/x$ on the interval $[1, 3]$. Then we do the following: **fnInt(1 \div x , x ,1,3)**. The answer appears as 1.09861228867.

READ THE TEXAS INSTRUMENTS MANUAL FOR MUCH MORE INFORMATION.