

## Toolkit for the TI-82 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  $\pi$  is obtained by pressing **2nd ^**

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

You should check that the calculator is reset to its factory settings. On the TI-83, press **2nd + 5 ENTER** (in order to clear any junk in the memory). On the TI-82: **2nd + 3 ENTER**

To obtain a blank screen, press **CLEAR** or **2nd MODE**

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**

On the TI-83, for the **X,T, $\theta$ ,n** key, **X** is for the  $x$  in  $f(x)$ , **T** is for parametric equations,  $\theta$  is for polar coordinates, and **n** is for the index of a sequence. To see which is current, press **MODE**; the fourth line has **Func Par Pol Seq**. Below we will write **X** for the **X,T, $\theta$ ,n** key. On the TI-82, the corresponding key is **X,T, $\theta$** .

### ENTERING MATHEMATICAL EXPRESSIONS

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

For  $x^2$ : press **X  $x^2$**  (alternatively, press **X ^ 2**)

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

For  $1/x$ : press **1  $\div$  X** (or press **X  $x^{-1}$** )

For  $\sqrt{x-5}$ : On the TI-83 press **2nd  $x^2$  X - 5 )** On the TI-82, **2nd  $x^2$  ( X-5 )**

For  $|4-x|$ : On the TI-83 press **MATH  $\rightarrow$  1 4 - X )** On the TI-82, **2nd  $x^{-1}$  ( 4 - X )**

For  $\sin \pi^4$ : On the TI-83 press **SIN 2nd ^ 4 )** On the TI-82, **2nd LN ( 3 X )**

For  $e^{3x}$ : On the TI-83 press **2nd LN 3 X )** On the TI-82, **2nd LN ( 3 X )**

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

To find the value of any expression at, say,  $x = 2$ , you can either press **2** instead of **X** as you enter the expression, or you can press **2 STO X 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 **RAD** is shaded.)

## ENTERING FUNCTIONS

To enter a function, press  $Y=$  and then the expression:

for  $f(x) = x^2$ , press  $Y= X x^2$  ENTER (the top line reads  $Y_1 = x^2$ ).

If there was an expression already in  $Y_1$ , you can erase it by CLEAR.

To access  $Y_2$ , 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 ENTER X - X (this yields  $x - x^2$ ) STO X

Press ENTER to find  $f(.3)$ , ENTER again to find  $f(f(.3))$ , etc.

## GRAPHING FUNCTIONS and ZOOMING IN

To graph a function such as  $x^3 - 2x - 2$ , press  $Y=$ , key in  $X^3 - 2X - 2$ , and then ENTER GRAPH  
The standard viewing window of  $-10$  to  $10$  on each axis is obtained by pressing ZOOM 6 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.

Press TRACE to put the cursor on the graph, then press  $\rightarrow$  or  $\leftarrow$  until the cursor is nearest to the  $x$  axis. The bottom of the screen displays the coordinates after each stroke of  $\rightarrow$  or  $\leftarrow$ . For example, one such set is  $X=1.7894737$   $Y=.15133401$ . Then press ZOOM 2 ENTER (which zooms in on the region centered at the exhibited coordinates). Repeat the sequence: TRACE  $\rightarrow$  or  $\leftarrow$ ,  $\rightarrow$  or  $\leftarrow$ , etc., until the cursor is nearest the  $x$  axis, and then ZOOM 2 ENTER Do until you achieve a satisfactory accuracy. We may obtain the following:

$x = 1.7631579$     $y = -.0451414$   
 $x = 1.7697368$     $y = -.00328634$   
 $x = 1.7680921$     $y = -.0088636$   
 $x = 1.7693257$     $y = 2.4616 E - 4$  (that is, .00024616)

CAUTION: The coordinates exhibited at the bottom of the screen are only approximate. It is not accurate to say that  $c = 1.7693257$ .

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

$x = 1.7685033$     $y = -.0058288$    and    $x = 1.7693257$     $y = 2.4616 E - 4$

The  $y$  values have different signs, so that  $c$  lies in the interval  $(1.7685033, 1.7693257)$ .

NUMERICAL DERIVATIVE: Press MATH 8 to access nDeriv(. There are four components:

nDeriv(function, variable, number at which the derivative is to be evaluated, desired accuracy).

For example, suppose we wish to find the derivative of  $x^3$  at 2.6, with an accuracy of 0.01. Then we would do the following: nDeriv( $x^3, x, 2.6, .01$ ). The answer appears as 20.2801. If we wish 0.001 accuracy, then we obtain 20.280001.

NUMERICAL INTEGRAL: Press MATH 9 ENTER to access fnInt(. There are five components:

fnInt(function, variable, lower limit of integration, upper limit of integration, desired accuracy).

For example, suppose we wish to find the integral of  $1/x$  on the interval  $[1, 3]$ , with an accuracy of 0.1. Then we would do the following: fnInt( $1 \div x, x, 1, 3, .1$ ). The answer appears as 1.098612289.

READ THE TEXAS INSTRUMENTS MANUAL FOR MUCH MORE INFORMATION.