

Calculating on the TI-82

0. START/END/QUIT

Press **ON** to start and **2nd****ON** (i.e. OFF) to turn the calculator off. The calculator will turn itself off after an inactive period, but nothing is lost when this happens. Just turn it back on.

If at some stage you are stuck, and can't see how to recover, QUIT, which is accessed by **2nd****MODE**, will allow you to start over.

1. SCREEN CONTRAST

The screen can be made darker or lighter to suit you. Press **2nd** and then hold down the **▲** key to darken the screen or press **2nd** and then hold down the **▼** to lighten the screen. Repeat until optimal for your light conditions.

2. SYNTAX

Calculations are performed by constructing an expression, in conventional algebraic syntax, and then pressing **ENTER**. Note that there is no equals key. Brackets are used when necessary. Some examples of acceptable syntax include the following, each of which is different from the equivalent on most scientific calculators, but is similar to the way expressions are conventionally written. Try each of these on your calculator, and observe both the screen display and the final result. It is not necessary to press **CLEAR** before each new calculation. Don't forget to press **ENTER**.

LOG**2****ENTER**

for $\log 2$

2**(****5*********(****1****)****)****ENTER**

for $2(5^2 - 1)$ (The multiplication sign is optional)

4*******(****1****)****ENTER**

for 4^{-1}

5**SIN****3****(****PI****)****ENTER**

for $5\sin 3$ (**PI** is obtained by **2nd****(****^****)**.)

(Multiplication signs are optional)

3**^****5****ENTER**

for 3^5

(**-****2****-****(****-****3****)****)****ENTER**

for $(-2) - (-3)$ (Note the use of **(-)** and **(-)** keys.)

2nd*******3****ENTER**

for $\sqrt{3}$

2nd**LN****2****ENTER**

for e^2

2nd*******(****2****-****9****)****ENTER**

for $|2 - 9|$. (The brackets are necessary to avoid calculating $|2| - 9$)

3. SUCCESSIVE COMMANDS

The screen will allow you to construct lengthy expressions if you want. Chain calculations are also permitted. The result of the most recent calculation is recorded as Ans. This result is used in chain calculations. It can also be directly recalled using **2nd****(****^-****)**. For example, try the following key sequence, and note carefully the screen and the successive results to see what is happening:

1**4****+****1****5****+****1****6****+****1****7****+****1****8****+****1****9****+****2****0****ENTER**

(**^-****)****ENTER**

*******ENTER**

*******ENTER**

Various constant operations can be performed by taking advantage of the fact that **ENTER** repeats the previous entry. Note the effect of the following key sequence:

3**ENTER**

+**5****ENTER****ENTER****ENTER**

4. USING MENUS

The TI-82 is menu-driven, which explains why the keyboard is relatively uncluttered. For example, many functions are located in the mathematics menu. To access this, press **MATH** and you will see the four sub-menus displayed, with the headings MATH, NUM, HYP and PROB. The cursor keys **←** and **→** allow you to move between these sub-menus. Note that **→→→** and **←** have the same effect, as the sub-menus wrap around the screen. Most menu symbols will be familiar.

To access a menu function, press its number. (Alternatively, use the **▲** and **▼** keys to select the desired function and press **ENTER**.) Conventional syntax is used so that generally you construct an expression as you would write it on paper. To leave a menu without selecting a function press **CLEAR**, which returns you to the home screen. Try the following examples of the use of menus:

7 MATH 3 ENTER	for 7^3
1 5 MATH ← 3 4 ENTER	for ${}_{15}C_4$
MATH ← 1 ENTER ENTER ENTER	for successive random numbers on (0,1)
MATH → 4 (-) 3 ▢ 1 ENTER	for $[-3.1]$, the greatest integer function
1 2 MATH ← 4 ENTER	for $12!$
SIN 6 0 2nd MATRX 1 ENTER	for $\sin 60^\circ$, overrides the radian default (uses Angle menu)
2 ÷ 7 + 3 ÷ 5 ENTER	for $2/7 + 3/5$ as a decimal, and then ...
MATH ENTER ENTER	converts the result to a fraction

5. MEMORIES AND VARIABLES

Memories are named alphabetically, as if variables are being given values. Store in a memory by using **STO** followed by **ALPHA** and the relevant key. For example, press **5** **STO** **ALPHA** **P** **ENTER** to store 5 in memory P. (Note the letter P is just above the **P** key.) In addition to memories A to Z, there is a memory accessed via the **3** key. Memories are recalled by first pressing the **ALPHA** key. The exception is memory X which can also be recalled using the **X.T.** key. Give Q the value 3 by storing 3 in memory Q and then note the effects of commands like the following:

ALPHA P ENTER	for P
6 ALPHA P ENTER	for 6P (Multiplication sign is optional.)
ALPHA P ALPHA Q ENTER	for PQ. (Multiplication sign is optional.)
3 ALPHA P ×² ALPHA Q ENTER	for $3P^2Q$ (Multiplication signs are optional.)
2nd ×² (ALPHA P ×² + ALPHA Q ×²) ENTER	for $\sqrt{P^2 + Q^2}$

6. EDITING COMMANDS

A command can be edited before **ENTER** is pressed by using the **←** and **→** keys. Move the cursor to the thing you want to change, and then write over it by pressing the desired keys. The **INS** and **DEL** keys allow you to insert or delete items. Move the cursor to the right spot first. You can execute a command at any time by pressing **ENTER**. It is not necessary to return the cursor to the end of the line.

The immediately previous command can always be recalled by pressing **2nd** **ENTER**. This is rather handy when a succession of values of a complex expression are sought. For example, if you have just found $17(1.02)^{20}$ with the key sequence

1 **7** **×** **1** **▢** **0** **2** **^** **2** **0**, to then evaluate $17(1.02)^{25}$ the following is sufficient:

2nd **ENTER** **←** **5** **ENTER**, and
2nd **ENTER** **←** **←** **3** **ENTER** will evaluate $17(1.02)^{35}$, and
2nd **ENTER** **←** **←** **←** **←** **5** **→** **1** **ENTER** will then evaluate $17(1.05)^{15}$, and so on.

Graphing on the TI-82

1. DEFINING A FUNCTION

To graph a function, you must first define the function. Press the $\boxed{Y=}$ key to access the function list of up to eight functions. If some functions are already defined, use $\boxed{\nabla}$ and $\boxed{\blacktriangle}$ to access them and then press $\boxed{\text{CLEAR}}$ to remove them before you start.

The $\boxed{\text{X.T.}}$ key enters the variable (x), and the other keys are used in the usual way. Standard algebraic syntax is used, so multiplication signs are optional. For example, to enter the function $f(x) = x^3 - 3x + 1$, press

$\boxed{\text{X.T.}} \boxed{\text{MATH}} \boxed{3} \boxed{-} \boxed{3} \boxed{\text{X.T.}} \boxed{+} \boxed{1}$

Once a function is defined, it will be graphed on pressing $\boxed{\text{GRAPH}}$. To see the graph on the standard screen for which $-10 \leq x \leq 10$ and $-10 \leq y \leq 10$, press $\boxed{\text{ZOOM}} \boxed{6}$.

Press $\boxed{Y=}$ to return to the function list if you want.

2. READING AND CHANGING THE SCREEN

Reading the screen is helped by using the cursor keys ($\boxed{\blacktriangleleft}$, $\boxed{\blacktriangleright}$, $\boxed{\blacktriangledown}$, $\boxed{\blacktriangleup}$). When these are pressed, a flashing cursor point is shown on the screen, and its coordinates given. Press some of these to see the effect. Move to the largest root to see $x = 1.6$.

If you press the $\boxed{\text{WINDOW}}$ key, you will see the current information about the x and y axes, which also helps interpreting the screen. The values of **Xscl** and **Yscl** determine the tick marks on the axes. Change the values of **Xmin**, **Xmax**, **Ymin** and **Ymax** by overwriting them. Use $\boxed{\blacktriangleup}$ and $\boxed{\blacktriangledown}$ to move between values. Press $\boxed{\text{GRAPH}}$ when done.

Press $\boxed{\text{GRAPH}}$ to return to the graph or $\boxed{Y=}$ to return to the function list.

3. TRACING A GRAPH

It is often convenient to trace prior to zooming in. A graph may be traced using the $\boxed{\text{TRACE}}$ key. A flashing cursor appears on the graph, and its coordinates appear at the bottom of the screen. This can be moved to left or right along the graph using $\boxed{\blacktriangleleft}$ or $\boxed{\blacktriangleright}$. After tracing, press $\boxed{\text{ENTER}}$ to move the center of the graph or $\boxed{\text{ZOOM}} \boxed{6}$ to return.

4. ZOOMING IN AND OUT

To get a more accurate view of part of the graph, we can 'zoom in', which is rather like using a magnifying glass; or we can see a bigger picture by 'zooming out'. Notice how zooming in makes curves 'straighter'. Press the $\boxed{\text{ZOOM}}$ key to access the ZOOM menu, then $\boxed{2} \boxed{\text{ENTER}}$ to zoom in on the cursor point. By repeating the process a few times, perhaps moving the cursor a little each time, a rather accurate approximation to the root at $x = 1.532$ can be found. Note that $\boxed{\text{ZOOM}} \boxed{3} \boxed{\text{ENTER}}$ zooms out, undoing the zooming in.

Return to the original graph at any time by $\boxed{\text{ZOOM}} \boxed{6}$, which uses a standard screen for which $-10 \leq x \leq 10$ and $-10 \leq y \leq 10$. $\boxed{\text{ZOOM}} \boxed{5}$ equates the scales on the two axes.

5. BOX ZOOMING

A particular part of the graph can be magnified by using the 'box' method. Press $\boxed{\text{ZOOM}} \boxed{1}$ to start. Then move the cursor to a point to the left of and above the part of the graph you wish to magnify. Press $\boxed{\text{ENTER}}$ to confirm your choice.

Then use the $\boxed{\blacktriangleright}$ and $\boxed{\blacktriangledown}$ keys to move to the right and below the parts of interest. A 'box' will be formed on the screen as you do this. When the appropriate part is boxed, press $\boxed{\text{ENTER}}$.

Use this procedure repeatedly to find the smallest root of f, at $x = -1.879$.

6. LEAVING THE GRAPH SCREEN

The home screen can be accessed at any time by pressing $\boxed{\text{CLEAR}}$. Alternately, any calculation will return the calculator to the home screen automatically. For example, to find $\sqrt{7}$ while a graph is showing, merely press $\boxed{2\text{nd}}\boxed{\times^2}\boxed{7}\boxed{\text{ENTER}}$. Other menus can be accessed from the graph screen by pressing the appropriate menu keys (such as $\boxed{\text{MATRIX}}$ or $\boxed{\text{MATH}}$.) Pressing $\boxed{\text{GRAPH}}$ will return to the graph screen.

Note also that pressing $\boxed{\text{X.T.}}\boxed{\text{ENTER}}$ will read memory X, which contains the current x-coordinate of the cursor. Similarly $\boxed{\text{ALPHA}}\boxed{1}\boxed{\text{ENTER}}$ will read memory Y, which contains the current y-coordinate of the cursor. These memories are changed continuously by graphing. Again, pressing $\boxed{\text{GRAPH}}$ will return to the graph screen.

7. GRAPHING MORE THAN ONE FUNCTION

Return to the function list using $\boxed{\text{Y=}}$. Use the $\boxed{\blacktriangledown}$ and $\boxed{\blacktriangle}$ keys to move the cursor to a new function. Define a function in the usual way. When $\boxed{\text{GRAPH}}$ is pressed, both (all) functions in the function list will be graphed together. The zoom and range facilities will now work on all functions at once. Once $\boxed{\text{TRACE}}$ is pressed, you can toggle among the functions defined using the $\boxed{\blacktriangle}$ and $\boxed{\blacktriangledown}$ keys. (To prevent a function from graphing, press $\boxed{\text{Y=}}$, move the cursor to the relevant = sign and press $\boxed{\text{ENTER}}$. Repeat to graph.)

8. AUTOMATIC CALCULATION

Various aspects of graphs can be automatically obtained from the calculation menu using $\boxed{2\text{nd}}\boxed{\text{TRACE}}$. Begin by selecting the aspect sought, $\boxed{1}$ to $\boxed{7}$. The syntax for these aspects varies. The value of the function at any point on the domain shown is obtained by entering the value, followed by $\boxed{\text{ENTER}}$. For roots, relative extrema and points of intersection, you must first use the cursor to identify a lower bound, an upper bound and a first approximation, pressing $\boxed{\text{ENTER}}$ after each one. The derivative is found by using the cursor to move to the appropriate point and then pressing $\boxed{\text{ENTER}}$. Definite integrals require you to select first the lower and then the upper limits, pressing $\boxed{\text{ENTER}}$ after each.

9. TABLES OF VALUES

Instead of a graph, a table of values for a function can be obtained. Use $\boxed{2\text{nd}}\boxed{\text{GRAPH}}$ to display a table. The values in the table can be scrolled up or down using the $\boxed{\blacktriangle}$ and $\boxed{\blacktriangledown}$ keys in the X column. The horizontal cursor keys $\boxed{\blacktriangleleft}$ and $\boxed{\blacktriangleright}$ show function values at the bottom of the screen for various x-values. The starting point (**TblMin**) and the x-increment (ΔTbl) for the table can be set using the TableSet functions available through $\boxed{2\text{nd}}\boxed{\text{WINDOW}}$. Adjust these by over-writing them.

10. SPLIT SCREENS

The TI-82 allows for the screen to be halved with a different aspect displayed on each half. To do this, select $\boxed{\text{MODE}}$, use the $\boxed{\blacktriangledown}$ and $\boxed{\blacktriangleright}$ keys to highlight **Split** on the bottom line and then press $\boxed{\text{ENTER}}$ to confirm your choice. Press $\boxed{\text{GRAPH}}$ to see the effect. The bottom of the screen can be either the function list (by pressing $\boxed{\text{Y=}}$) or a table of values (by pressing $\boxed{2\text{nd}}\boxed{\text{GRAPH}}$). The screen halves work in the usual way, and can be accessed with the usual keys, $\boxed{\text{GRAPH}}$, $\boxed{\text{Y=}}$ or $\boxed{2\text{nd}}\boxed{\text{GRAPH}}$. Return to the normal mode by selecting **FullScreen** from the $\boxed{\text{MODE}}$ menu and then pressing $\boxed{\text{ENTER}}$.

11. POLAR GRAPHS

For polars, first select $\boxed{\text{MODE}}$, use the $\boxed{\blacktriangledown}$ and $\boxed{\blacktriangleright}$ keys to highlight **Pol** on the fourth line and press $\boxed{\text{ENTER}}$ to confirm your choice. Press $\boxed{\text{Y=}}$ to define functions. Note **r** has replaced **y** and $\boxed{\text{X.T.}}$ now gives **r** rather than X. Use $\boxed{\text{ZOOM}}\boxed{5}$ to graph with equal scales.