

Turning it on and off:

To turn the calculator on, press the **ON** key in the lower left corner.  
 You should now see a flashing rectangle, the cursor, on the screen.

<u>If instead you see</u>	<u>Press</u>
a black screen	<b>2nd</b> $\nabla$ repeatedly until you see something.
unchanged	<b>ON</b> again. If that doesn't work, press <b>2nd</b> $\blacktriangle$ repeatedly until you see something.
anything else	<b>EXIT</b> until you see the flashing rectangle.

To turn the calculator off, press **2nd OFF**. The calculator will turn itself off if left unattended. In such instances, the calculator will come back on in the state it turned off in. While if you turn it off, it will come on at the home screen.

The Keys:

First notice that many of the keys have writing not only on them but above them. For example, the **X** key has **MATH** in yellow and the letter **O** in blue above the key.

<u>writing color</u>	<u>position</u>	<u>accessed</u>	<u>example</u>
white	on the key	just press the key	the key <b>X</b> prints the multiplication symbol, "*".
yellow	above the key	press <b>2nd</b> first	<b>2nd MATH</b> displays the <b>MATH</b> menu across the bottom of the screen. Press <b>EXIT</b> to get rid of it.
blue	above the key	press <b>ALPHA</b> first or <b>2nd alpha</b> first	<b>ALPHA O</b> prints the upper case letter O. <b>2nd alpha O</b> prints the lower case letter o.

Cursor modes:

rectangle	regular type-over mode
underline	regular insert mode
arrow-up	ready for a <b>2nd</b> (yellow) function
capital A	ready to print a capital (blue) letter
lower-case a	ready to print a lower-case (blue) letter

Keys of interest to College Algebra( look for them as you read )

<u>General</u>	<u>Primary Operation</u>
,	separating parameters
<b>2nd</b>	accesses the yellow functions above a key
<b>A,B,...,Z</b>	names of variables
<b>ALPHA , alpha</b>	accesses the blue characters, in upper and lower case respectively, above a key
<b>ANS</b>	prints the variable <b>ANS</b> , which contains the previous answer
<b>CLEAR</b>	clears the command line or the home screen
cursor keys ( $\blacktriangleleft$ $\blacktriangleright$ $\blacktriangleup$ $\blacktriangledown$ )	moves the cursor left, right, up and down respectively and adjusting screen brightness
<b>DEL</b>	deletes the character under the cursor
<b>EE</b>	for scientific notation
<b>ENTER</b>	executes a command
<b>ENTRY</b>	recalls the previous command
<b>EXIT</b>	exits a menu or screen
<b>F1,F2,F3,F4,F5</b>	menu keys
<b>INS</b>	sets the cursor to insert mode
<b>MODE</b>	to change the settings on the calculator
<b>MORE</b>	goes to the next page of a menu
<b>ON , OFF</b>	turns the calculator on and off respectively
<b>STO</b> $\blacktriangleright$	stores a number into a variable
<b>x-VAR</b>	prints the variable x

<u>menu</u>	<u>Primary Operation</u>
<b>CATLG-VARS</b>	accesses commands and variables
<b>CONV</b>	converting units
<b>CUSTOM</b>	your own menu you can customize
<b>GRAPH</b>	graphing functions
<b>MATH</b>	math functions not on the keys
<b>MEM</b>	memory status and delete variables

<u>functions</u>	<u>prints</u>	<u>Primary Operation</u>
+,-,X,÷	+,-,*,/	add, subtract, multiply, and divide respectively
^	^	exponent, "raised to the power of"
$\sqrt{\quad}$	$\sqrt{\quad}$	square root :see p4 for general root function
(, )	(, )	grouping :DON'T use [ ] or { } for grouping
(-)	-	negative sign
.	.	decimal point
0,1,2,...,9	0,1,2,...,9	digits
$\pi$	$\pi$	the number pi $\approx$ 3.14159..
$10^x$	$10^{\wedge}$	common exponential function
$e^x$	$e^{\wedge}$	natural exponential function
LOG	log	common logarithm
LN	ln	natural logarithm
$x^{-1}$	-1	reciprocal
$x^2$	2	square function

Contrast adjustment and batteries:

As the batteries become weaker, you will have to adjust the screen's brightness.

If the screen is too light or too dark adjust it by pressing **2nd**  $\blacktriangledown$  to lighten it or **2nd**  $\blacktriangle$  to darken it. Important: when doing this, watch the upper right corner. A number will appear briefly. When it gets to 7, you will need to replace the AAA batteries soon. When it gets to 9, replace them immediately.

As long as you only change the AAA batteries, without changing the lithium ones, memory will be retained. If you replace the AAA batteries when suggested, you should never have to touch the lithium batteries at least not for years. But if you let the AAA batteries go dead, the calculator will pull power from the lithium batteries, shortening their life.

Entering Commands:

To perform basic arithmetic, type in the expression on the command line and press **ENTER**.

<u>To evaluate</u>	<u>type</u>	<u>prints as</u>	<u>Answer</u>
6 + 4	6 + 4	6+4	10
2-3 · 4	2 - 3 X 4	2-3*4	-10
$(-3)^3$	( (-) 3 ) ^ 3	(-3)^3	-27
$3^5 - 4^2$	( 3 ^ 5 - 4 x^2 ) ÷ 8	(3^5-4^2)/8	28.375
8			

Most common errors:

Order of operation: Notice how the last example needed parenthesis even though they were not in the original expression. This is because without them, the division would have been done before the subtraction.

Also, functions like  $\sqrt{\quad}$  and **abs** are done before most other operations. Thus, " $\sqrt{\quad} 4(9)$ " will return "18" since it will do the square root of 4 then multiply that by 9.

The wrong minus sign: Subtractions must be done with - key in the right most columns of keys. While negative numbers are entered with the (-) key at the bottom of the keys. Though using - instead of (-) will likely lead to an error, using (-) for - won't. It will be treated as a multiplication by -1.

Note: The calculator keeps the last answer in the variable ANS. So if you want to take the square root of the last answer, press **2nd**  $\sqrt{\quad}$  **2nd ANS ENTER**.

If you press **ENTER** without a command, it performs the previous command again.

If you want to add 5 to the last answer, you can just type **+ 5 ENTER** and the calculator will print "Ans+5" and the new answer.

### Editing a command:

No matter how much experience or knowledge we may have, errors are going to happen. And, after the third attempt at typing the same command, you'll want to learn to edit.

*Example 1* Dealing with an error.

First type  $( - 9 ) ^ 6$  . Note the wrong minus sign.

Press **ENTER**

The calculator will tell you that a syntax error has occurred and gives you the options **GOTO** and **QUIT**.

Press **F1:GOTO**

The command will appear at the top of the screen with the cursor where it detected the error.

To make the correction, type  $( - )$  **ENTER**.

The calculator returns "531441".

*Example 2* Typing over the command.

Type **528 X 651**. Don't press **ENTER**.

But, I meant to multiply 582 by 651.

Instead of retyping the whole command, move the cursor on top of the 2 by pressing  $\leftarrow$  6 times.

Type **82** on top of the 28 and press **ENTER**.

The calculator returns "378882".

*Example 3* Changing the previous command.

Type  $( ( - ) 3 - 2\text{nd } \sqrt{\quad} ( 3x^2 - 4x + 2x + 1 ) ) \div ( 2x + 2 )$  **ENTER**.

Note, this is one of the solutions to  $2x^2 + 3x + 1 = 0$

The calculator returns "-1".

Instead of retyping the entire command again to get the other solution, press **2nd ENTRY** to recall the command and edit it.

Move the cursor on top of the first subtraction sign by pressing  $\uparrow \rightarrow \rightarrow$ .

Replace - with + by typing +.

Press **ENTER**.

The calculator returns "-.5" .

*Example 4* Inserting.

Type 745. Don't press **ENTER**.

To turn this into 74+5, first press  $\leftarrow$  .

Enter insert mode by pressing **2nd INS**. Now the cursor has changed to an underline and anything typed will be put between the 4 and 5.

Type + **ENTER**.

The calculator returns "79".

*Example 5* Deleting.

Type **58 + X 89**. Don't press **ENTER**.

Move the cursor on top of the + sign by pressing  $\leftarrow \leftarrow \leftarrow \leftarrow$ .

To delete the character under the cursor press **DEL**.

Press **ENTER**.

The calculator returns "5162".

### Menus:

Since having all of the calculator's operations accessible directly from the keyboard means that it would need at least twice the number of keys, many of the calculator's functions are in the menus. For instance, the only root function you will find on the keyboard is the square root function,  $\sqrt{\quad}$  . To get to the general root function, we must first enter the math menu by pressing **2nd MATH**. The bottom of the screen should look like:

```
NUM | PROB | ANGLE | HYP | MISC |
```

These are the first five items in the math menu. I know there are more items because of the arrow on the right. To access the next page of menu options, press **MORE**. Now you should see:

```
INTER | | | |
```

Notice this is the last page for this menu since there isn't an arrow on the right. To get back to the first page of items press **MORE** again.

Now we want to go into the miscellaneous submenu. Below the screen you'll see the 5 menu keys **F1, F2, F3, F4, F5** which are used to access the menu items. Since the abbreviation "misc" is above **F5** press **F5:MISC**. This means press the key **F5** with the item **MISC** over it. Now you should see:

NUM	PROB	ANGLE	HYP	MISC
SUM	PROD	SEQ	TCM	3cd

Because none of these look like a root function press **MORE**. And over **F4** you should see.

NUM	PROB	ANGLE	HYP	MISC
√Frac	2	√Evd1	*√	√vd1

To take the cube root of 8, you press **3 F4: \*√ 8 ENTER**

To back out of a submenu, press **EXIT**. You're now in the math menu. To get out of it, press **EXIT** again.

NOTE: you can type normally even when this menu is on the screen.

The Catalog:

Some functions and commands are found more easily in the catalog. To enter the catalog press **2nd CATLG-VARS F1:CATLG**.

You should now see a list of commands and functions. You can move through the list by pressing

- ▲ or ▼ to move item by item up or down.
- F1:PAGE** ↓ or **F2:PAGE** ↑ to move by pages down or up.
- the first letter in blue to go to the start of the command beginning (without the **ALPHA** key) with that letter.

Hence, to find the command **rand** press **R**. Now **rand** should be third down the screen. To get the command on the home screen, move the pointer, the arrow on the left of the screen, down until it is pointing at the command **rand** by pressing **▼ ▼**. Then, press **ENTER**. You'll be returned to the home screen and **rand** will now be on the command line.

If you press **ENTER** now, the calculator will print a random number between 0 and 1. Try it. Press **ENTER** a couple of times. Each time you'll get a different number.

NOTES: Symbols are at the bottom of the list.

A fast way to get to the bottom of the list is pressing **A ▲**. The **A** isn't needed if you are already at the top of the catalog.

The TI-86 will return to wherever you were when you left the catalog last. Press **EXIT** to exit the catalog without selecting a function.

The Custom Menu:

If you ever get tired of searching through menus and submenus to find that commonly used function, put it in the custom menu. For example, to put **\*√** into the custom menu.

Enter the catalog.

Press **2nd CATLG-VARS F1:CATLG**.

Find the function.

Press **A ▲** then **F2:PAGE** ↑ 6 times then **▼** 4 times.

Enter the custom submenu.

Press **F3:CUSTOM**.

Press the menu key where you want it. You can access the 2<sup>nd</sup> and 3<sup>rd</sup> page by pressing **MORE**.

For instance, press **F1** on the 1<sup>st</sup> page.

**\*√** should now be in the menu over **F1**. Press **EXIT EXIT** to return to the home screen.

To use the custom menu, press **CUSTOM** and use it like any other menu.

To delete a custom menu item:

Enter the catalog.

Press **2nd CATLG-VARS F1:CATLG**

Press **F4:BLANK**.

If the item isn't showing press **MORE** until it is.

Press the function key for that item. For example, if you want to get rid of  $x\sqrt{\quad}$  that we entered earlier, press **F1** and  $x\sqrt{\quad}$  will disappear. Press **EXIT EXIT** to return to the home screen.

#### Variables:

The calculator doesn't store numbers in memory like a scientific calculator. Instead, it stores them in variables like computers.

To store a number into a variable, for example storing 7 in A, type **7 STO▶ A ENTER**.

It will print as "7 → A" and "7" will be returned as the answer.

To use a variable, type the variable name where you would put it's number. For instance, to evaluate  $2A+4$  for A=7 entered earlier, type **2 ALPHA A + 4 ENTER**. The calculator will return "18".

To delete a variable, enter the memory menu by pressing **2nd MEM**.

Then select **F2:DELET F2:REAL**.

\*\*Warning it is easy to delete the wrong variable, So your keep your fingers away from the ENTER key until you're ready\*\*

Put the arrow on the variable to delete using the **▼** or **F1:PAGE ↓**.

Make sure the arrow is on the variable you want to delete. Then press **ENTER**.

It is now erased. Press **EXIT** to return to the home screen.

Note: When storing variables, you don't press **ALPHA** before the variable's name. In fact, in the above example, if you do press **ALPHA** after **STO▶**, you will get "log" instead of "A" because you will take it out of Alpha mode. Variable names can be up to 8 characters long. The calculator is case sensitive. That means,  $a \neq A$ . Some names are reserved by the calculator, i.e. "a", "b", commands and functions.

#### Math Menu:

In the math menu are functions not found on the keys.

First let's enter the math menu. Press **2nd MATH**. The only 2 submenus of interest to College Algebra are Num(bers) and Misc(ellaneous).

##### The number submenu:

Press **F1:NUM** to enter the number submenu.

**round( number, # of decimals )**: rounds a number to the specified number of decimals.

Ex. **F1:round 3.23456 , 2 ) ENTER** returns "3.23".

**iPart number**: returns the integer part, the digits to the left of the decimal point, of a number.

Ex. **F2:iPart 35.78 ENTER** returns "35".

**fPart number**: returns the fractional part, the digits to the right of the decimal point, of a number.

Ex. **F3:fPart 35.78 ENTER** returns ".78".

**int number**: returns the greatest integer less than or equal to a number. Also, referred to as the bracket function.

Ex. **F4:int (-) 3.5 ENTER** returns "-4".

**abs number**: returns the absolute value of a number.

Ex. **F5:abs (-) 6.8 ENTER** returns "6.8".

##### The miscellaneous submenu:

If you are still in the number submenu, press **EXIT**. Now press **F5:MISC** to enter the miscellaneous submenu. And since the only functions of interest to us are on the second page, press **MORE**.

**number ▶Frac**: tries to convert a number to a fraction.

Ex. **1.5 F1:▶Frac ENTER** returns "3/2".

**index  $x\sqrt{\quad}$  radicand**: is the general nth root function.

Ex. **4 F4: $x\sqrt{\quad}$  81 ENTER** returns the 4th root of 81, "3".

### Conv(ersion) Menu:

The conversion menu is used for converting between different units of measurement. There are submenus for length, area, volume, time, temperature, etc.

*Example* convert 15ft to meters

Enter the conversion menu.

Press **2nd CONV**.

Enter the length submenu.

Press **F1:LNTH**.

Enter the measurement to be converted.

Type **15 F5:ft**. Note the conversion arrow, "►".

Enter the new units.

Press **F3:m**.

Enter command.

Press **ENTER**. The calculator returns "4.572".

### Var(iable)s Menu:

The variables menu allows access to any variable stored in memory.

First let's store a variable. Type **4.65 STO► Y ENTER**.

Press **2nd CATLG\_VARS** to enter the variables menu.

The submenus are the different types of variables the calculator recognizes as well as an all submenu to get a list of every variable.

Since we stored a real number onto Y, press **F3:REAL**.

Find the variable Y (upper case) in the list and put the arrow on it using **▲, ▼, F1:Page ↓**,

and **F2:Page ↑**.

Press **ENTER** and "Y" is placed on the command line where the cursor was before entering the variables menu.

Press **ENTER** and the calculator returns "4.65".

Note: All capitals come before lower-case in the list. For example, "Zprog" would come before "aprog".

### Complex numbers:

The TI-86 has a odd way of dealing with complex numbers.

Type  $\sqrt{\quad}$  **(-) 1 ENTER**. The calculator returns "(0,1)" not  $i$ .

The calculator's notation for  $a+bi$  is (a,b).

Beyond this, the calculator can add, subtract, etc. complex numbers just like real numbers.

Example 1. multiply  $(2+5i)$  by  $(3-8i)$

1. Type **( 2 , 5 ) X ( 3 , (-) 8 ) ENTER**.

2. The calculator returns "(46,-1)".

3. Thus, the answer is  $46-i$ .

Example 2. Raise -8 to the  $2/3$  power.

0. First, let's get the answer by hand.

$$(-8)^{2/3} = (\sqrt[3]{-8})^2 = (-2)^2 = 4.$$

1. Ok now type **( (-) 8 ) ^ ( 2 ÷ 3 ) ENTER**.

2. The TI-86 will return "4".

Note: On tests always use standard form,  $a+bi$ , not the calculator's notation.

### Mode Settings:

Press **2nd MODE**.

You'll get a screen with of settings for how the calculator behaves. The only ones of interest to College Algebra are:

**Normal Sci Eng** : Sets whether the calculator returns (for 56945)  
normal notation | 56945  
scientific notation | 5.6945E4 (See below)  
engineering notation | 56.945E3 (not used in MAC1105)

**Float 012345678901** : Sets how many decimals to round to (for 0.25)

Float	.25	( all the decimals up to 11 )
1st 0	0	( zero decimals )
1st 1	.3	( one decimal )
2	.25	( two decimals )
3	.250	( three decimals )
4	.2500	( four decimals )
5	.25000	( five decimals )
6	.250000	( six decimals )
7	.2500000	( seven decimals )
8	.25000000	( eight decimals )
9	.250000000	( nine decimals )
2nd 0	.2500000000	( ten decimals )
2nd 1	.25000000000	( eleven decimals )

As for the rest, they should all be set to the left most setting.

To change a setting, press **▼** until the cursor is on the line you want to change. For example,

press **▼** once to change the number of decimals displayed.

Press **►** until the cursor is on the new setting.

i.e. move the cursor to the 2.

Press **ENTER** to make the change.

If you followed the example, your calculator will now print all numbers rounded to the hundredths. To change it back, enter the mode screen, move the cursor on the word **FLOAT**, and press **ENTER**.

To exit the mode screen, press **EXIT**.

### Scientific Notation:

The calculator uses a version of scientific notation used on many computers.

$3.4 \times 10^6$  is printed on the calculator as "3.4E6".

To enter  $7.84 \times 10^5$ , type **7.84 EE 5 ENTER**. It will print as "7.84E5" and return "784000". You can also type **7.84 X 10 ^ 5 ENTER**.

When the calculator is set to **NORMAL**, see **MODE** above, the calculator will print any number that has more than 12 digits ( i.e  $0.000000000000005 = 5 \times 10^{-15}$  ) in its version of scientific notation ( 5E-15 ).

When scientific notation is asked for on tests and homework, use standard scientific notation,  $5 \times 10^{-3}$  .