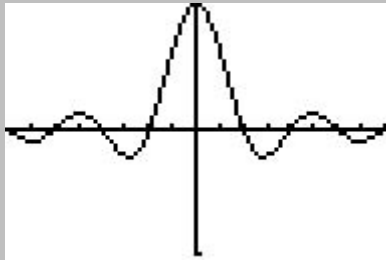


# Graphics Calculators

Starting in ninth grade, you may use school provided calculators on exams.

Today you will learn many of the features available on TI graphics calculators.

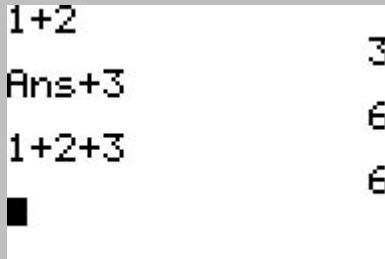


## Plain Vanilla

The number pad and  $+$   $-$   $\times$   $\div$  keys work as normal.

The ENTER key calculates whatever expression was just entered.

The previous answer will automatically be used if the next expression begins with an operation.



```
1+2           3
Ans+3         6
1+2+3        6
█
```

The previous answer can also be used by the **STO**,  $x^{-1}$  and  $x^2$  keys.

## Negative vs Minus

The (-) key is used for negative numbers (the unary change sign operator).

On the calculator, it shows up as being raised relative to the regular - key (the binary subtraction operator).

Using the wrong minus key can give the wrong answer or cause an error.

-2+3		ERR:SYNTAX
Ans-2+3	1	1:Quit
(-2+3)	2	2:Goto

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## Proper Fractions

Example:  $3\frac{2}{7} = (3 + 2/7)$

## Parentheses are your Friends

Evaluate the expression  $\frac{4+6}{3+7}$

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$4+6/3+7$	
$(4+6)/(3+7)$	13
	1

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```
4+6/3+7      13
(4+6)/(3+7)   1
```

Evaluate  $-x^2$  when  $x = 2$  and  $x^2$  when  $x = -2$ .

## Parentheses are your Friends

Evaluate the expression  $\frac{4+6}{3+7}$

$4+6/3+7$	
$(4+6)/(3+7)$	13
	1

Evaluate  $-x^2$  when  $x = 2$  and  $x^2$  when  $x = -2$ .

$-(2)^2$	
$(-2)^2$	-4
$-2^2$	4
	-4



## White, Yellow/Blue and Green

Almost all the keys have three labels: one in white on the key itself, one in yellow (or blue) and one in green above the key.

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The green **ALPHA** key allows one to select the options labeled above the keys in green (mostly letters).

**2nd ALPHA** will turn on letters until the **ALPHA** key is hit again.



```
ONLY DORKS DO  
THIS. █
```

## Reset

The **CLEAR** and/or **2nd QUIT** keys will get you back from most places.

To clear memory and reset all the settings to their default values, enter the sequence

**2nd + 7 1 2**

## Reset

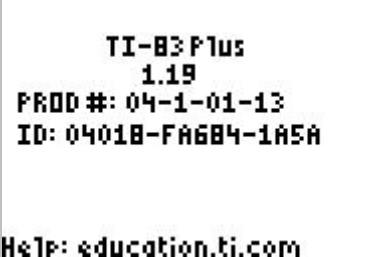
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Each calculator has a unique ID. To see this ID number, hit

**2nd + 1**



TI-83 Plus  
1.19  
PRD#: 04-1-01-13  
ID: 0401B-FA6B4-1A5A

Help: [education.ti.com](http://education.ti.com)

## Editing

Expressions may be edited using the left and right arrow keys, **DEL** (delete) and **2nd INS** (insert) buttons.

The **CLEAR** button erases the whole line or the whole screen.

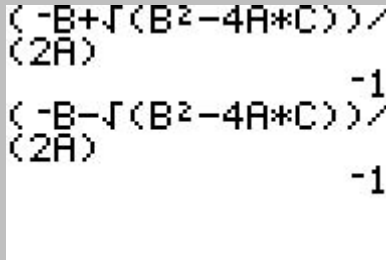
Previously entered expressions can be recalled by hitting the **2nd ENTRY** key (until the desired line appears).

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The image shows a calculator screen with two lines of text. The first line is  $(-B + \sqrt{B^2 - 4AC}) / (2A)$  and the second line is  $(-B - \sqrt{B^2 - 4AC}) / (2A)$ . To the right of each line, the number -1 is displayed, indicating the cursor position.



## Menus

To select a menu item, one can either type in the number (if used) or move the cursor up and down using the up and down arrow keys and hit **ENTER**.

If more than one menu is possible, one can switch between them using the left and right arrow keys.

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For example, the **MATH** key brings up 4 possible menus, labeled **MATH** **NUM** **CPX** and **PRB**.

```
MATH NUM CPX PRB
1: ▸Frac
2: ▸Dec
3: 3
4: 3√(
5: *√
6: fMin(
7: ↓fMax(
```

```
MATH NUM CPX PRB
1: abs(
2: round(
3: iPart(
4: fPart(
5: int(
6: min(
7: ↓max(
```

```
MATH NUM CPX PRB
1: conj(
2: real(
3: imag(
4: angle(
5: abs(
6: ▸Rect
7: ▸Polar
```

```
MATH NUM CPX PRB
1: rand
2: nPr
3: nCr
4: !
5: randInt(
6: randNorm(
7: randBin(
```

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```
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1: rand
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The down arrow (▾) indicates that there are more menu items available than shown.

## Scientific Notation

The **MODE** menu allows one to display numbers in scientific notation (**Sci**).

The **E** separates the exponent (base 10), so  $123 = 1.23 \times 10^2$  would be displayed as 1.23E2.

The **2nd EE** key allows you to enter numbers using scientific notation. Hitting

**3 2nd EE 8**

will produce  $3 \times 10^8$ .

One can also use the **2nd 10<sup>x</sup>** key.

```
Normal Sci Eng
Float 0123456789
Radian Degree
Func Par Pol Seq
Connected Dot
Sequential Simul
Real a+bi re^θi
Full Horiz G-T
```

```
3E8
300000000
3*10^(8)
3E8
3*10^(8)
300E6
█
```

Engineering notation (**Eng**) is similar to **Sci**, except it uses powers of 1000.

## Floating vs. Fixed Point

The MODE menu also allows you to specify how many decimals accuracy you want to display.

```
Normal Sci Eng
Float 0123456789
Radian Degree
Func Par Pol Seq
Connected Dot
Sequential Simul
Real a+bi re^θi
Full Horiz G-T
```

```
1 1.0000
π 3.1416
.005 .0050
■
```

# Exponents

Exponents use the ^ key.

The  $x^2$   $x^{-1}$   $\sqrt{\quad}$   $10^x$  and  $e^x$  can also be used for those specific exponents or bases.

$$\sqrt{x} = x^{1/2}$$

<code>2^2</code>	<code>4</code>
<code>2^3</code>	<code>8</code>
<code>2^4</code>	<code>16</code>
<code>■</code>	

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$$\sqrt{x} = x^{1/2}$$

2^2		MATH NUM CPX PRB
	4	1: ▸Frac
2^3		2: ▸Dec
	8	3: 3
2^4		4: 3√(
	16	5: *√
■		6: fMin(
		7: ↓fMax(

In addition, the **MATH** menu includes  $x^3$   $\sqrt[3]{\quad}$  and  $\sqrt{x}$ .

## Storing Numbers

On a calculator, a variable is just a place to store numbers.

All 1 letter names can be used to store and recall numbers using the **STO** and **2nd RCL** keys.



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For example, evaluate  $x^2 + 2x + 1$  when  $x = -4$  :

```
-4→X          -4
X²+2X+1       9
(-4)²+2(-4)+1 9
```

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X²+2X+1
(-4)²+2(-4)+1
-4
9
9
```

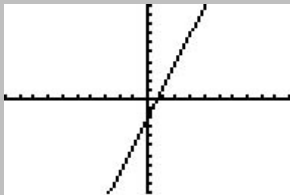
```
√(2)→X
1.414213562
X²
2
1.41²
1.9881
■
```

Every time you round a number you lose accuracy.

## Graphing

To graph the function  $y = 3x - 2$  one can hit the **Y=** button and enter  $3X - 2$  after  $\backslash Y_1 =$ , then hit **GRAPH**.

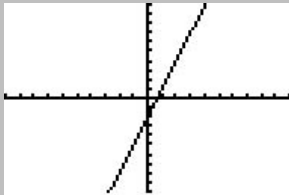
```
Plot1 Plot2 Plot3
\Y1= 3X-2
\Y2=
\Y3=
\Y4=
\Y5=
\Y6=
\Y7=
```



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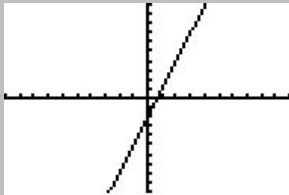
```
WINDOW
Xmin=-10
Xmax=10
Xscl=1
Ymin=-10
Ymax=10
Yscl=1
Xres=1
```

The **WINDOW** button allows one to control the size of the graph and how far apart the tick marks on the axis are located.

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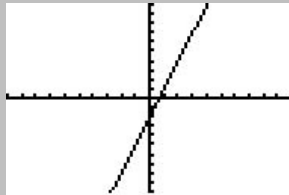
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The **ZOOM** button performs a similar function. **ZOOM 6** resets the window to its default values.

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Up to 10 different functions can be graphed at the same time.

## Tables

The **2nd TABLE** button reports the X and Y coordinates (for **Y=**) in table form.

X	Y <sub>1</sub>	
-3	-7	
-2	-4	
-1	-1	
0	2	
1	5	
2	8	
3	11	

X = -3

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0	2	
1	5	
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3	11	

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```
TABLE SETUP
TblStart=-3
ΔTbl=1
Indent:  Auto Ask
Depend:  Auto Ask
```

The **2nd TBLSET** button controls the starting X value and how far apart to generate table values.



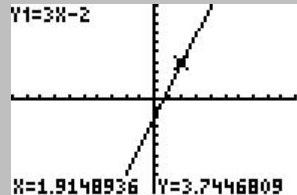
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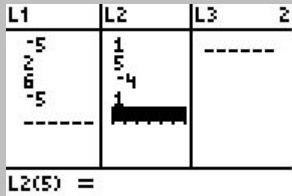
The **TRACE** button also reports X and Y values, but for one function and one point at a time. The function and point selected can be moved using the arrow keys.

## Plotting Points

One can also plot specific X and Y coordinates previously recorded. Up to 3 separate such plots can be shown together. Be sure to **CLEAR** out any functions in the **Y=** menu.

## Plotting Points

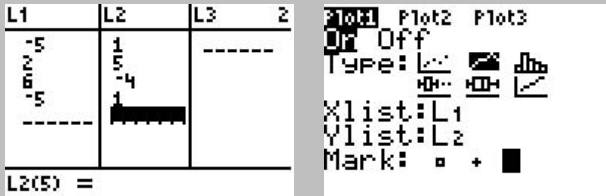
One can also plot specific X and Y coordinates previously recorded. Up to 3 separate such plots can be shown together. Be sure to **CLEAR** out any functions in the **Y=** menu.



To enter these numbers use **STAT 1**. The number you type in is not recorded until you hit the **ENTER** button. You can select which entry to edit using the arrow keys. The **DEL** button will remove an entry (until you start typing). **2nd MEM 4 ENTER** will clear all lists.

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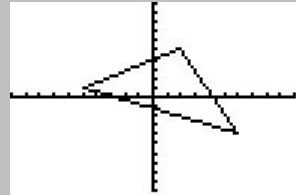
**2nd STATPLOT ENTER** brings up the menu for **Plot1**.

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L1	L2	L3	2
-5 -5	1 4	-----	
-----	█		
L2(5) =			

```
Plot1 Plot2 Plot3
On Off
Type: L1
Mark:
Xlist:L1
Ylist:L2
Mark: □ + █
```



To enter these numbers use **STAT 1**. The number you type in is not recorded until you hit the **ENTER** button. You can select which entry to edit using the arrow keys. The **DEL** button will remove an entry (until you start typing). **2nd MEM 4 ENTER** will clear all lists.

**2nd STATPLOT ENTER** brings up the menu for **Plot1**.

**GRAPH** will then show the plot.

Wait, there's more!

In truth we have just scratched the surface of what this calculator is capable of.