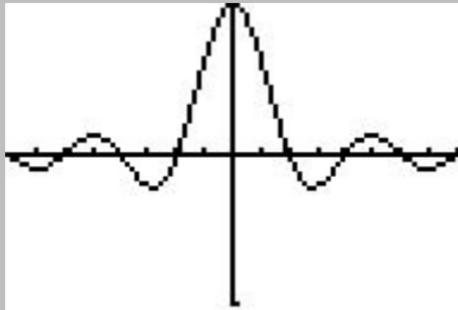


Graphics Calculators

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.

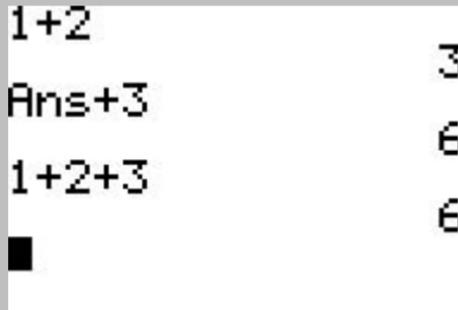


Plain Vanilla

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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-2+3		ERR:SYNTAX
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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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Evaluate the expression $\frac{4+6}{3+7}$

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

Parentheses are your Friends

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

```
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

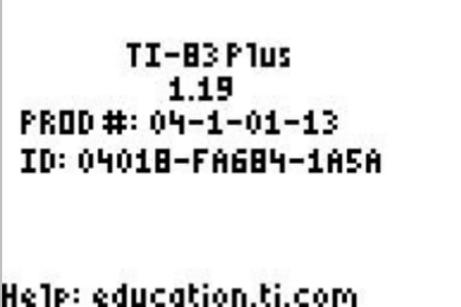
The **CLEAR** and/or **2nd QUIT** keys will get you back from most places.

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

2nd + 7 1 2

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

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.

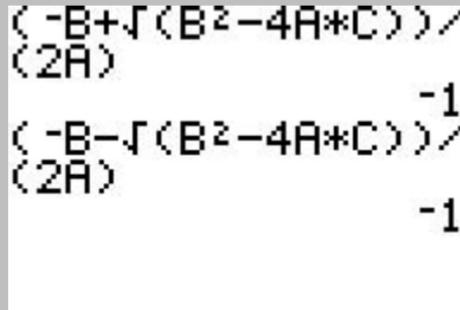
Previously entered expressions can be recalled by hitting the **2nd ENTRY** key (until the desired line appears).

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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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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 3×10^8 .

One can also use the **2nd 10^x** 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.

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

2^2	4
2^3	8
2^4	16
■	

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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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9
9
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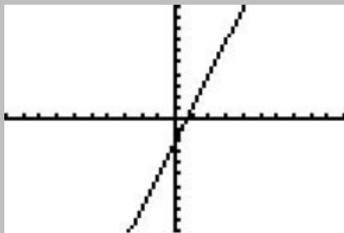
```
√(2)→X
1.414213562
X²
2
1.41²
1.9881
■
```

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 $\backslashY_1 =$, then hit **GRAPH**.

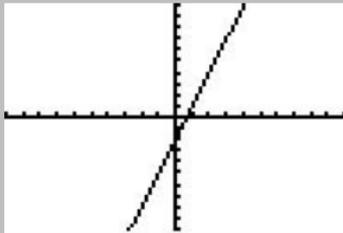
```
Plot1 Plot2 Plot3
\Y1=3X-2
\Y2=
\Y3=
\Y4=
\Y5=
\Y6=
\Y7=
```



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\Y6=
\Y7=
```



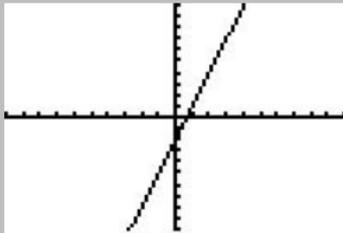
```
WINDOW
Xmin=-10
Xmax=10
Xscl=1
Ymin=-10
Ymax=10
Yscl=1
Xres=1
```

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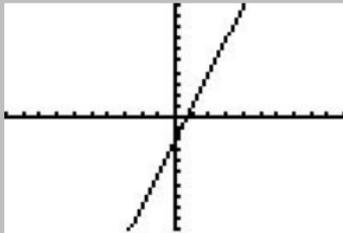
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Up to 10 different functions can be graphed at the same time.

Tables

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

X	Y ₁	
-3	-7	
-2	-4	
-1	-1	
0	2	
1	5	
2	8	
3	11	

X = -3

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-1	-1	
0	2	
1	5	
2	8	
3	11	

X = -3

```
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.

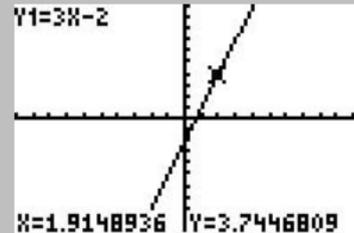
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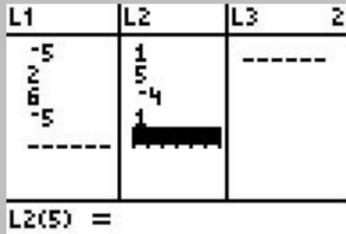
The **TRACE** button also reports X and Y values, but for one function and one point at a time. The function and point selected can be moved using the arrow keys.

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

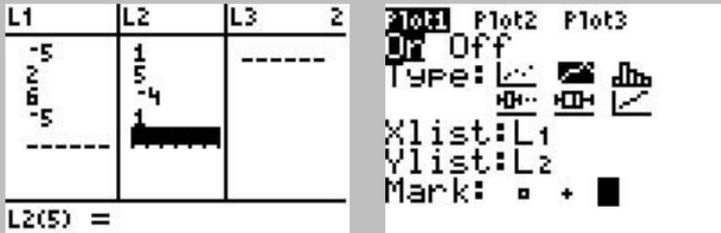
One can also plot specific X and Y coordinates previously recorded. Up to 3 separate such plots can be shown together. Be sure to **CLEAR** out any functions in the **Y=** menu.



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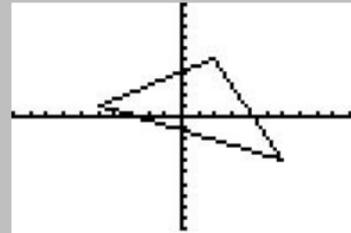
2nd STATPLOT ENTER brings up the menu for **Plot1**.

Plotting Points

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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: □ + ■
```



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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.