The Quadratic Formula

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

use for finding solutions (roots) to equations of the form:

$$ax^2 + bx + c = 0$$

where a, b, and c are numbers, and a ≠ 0
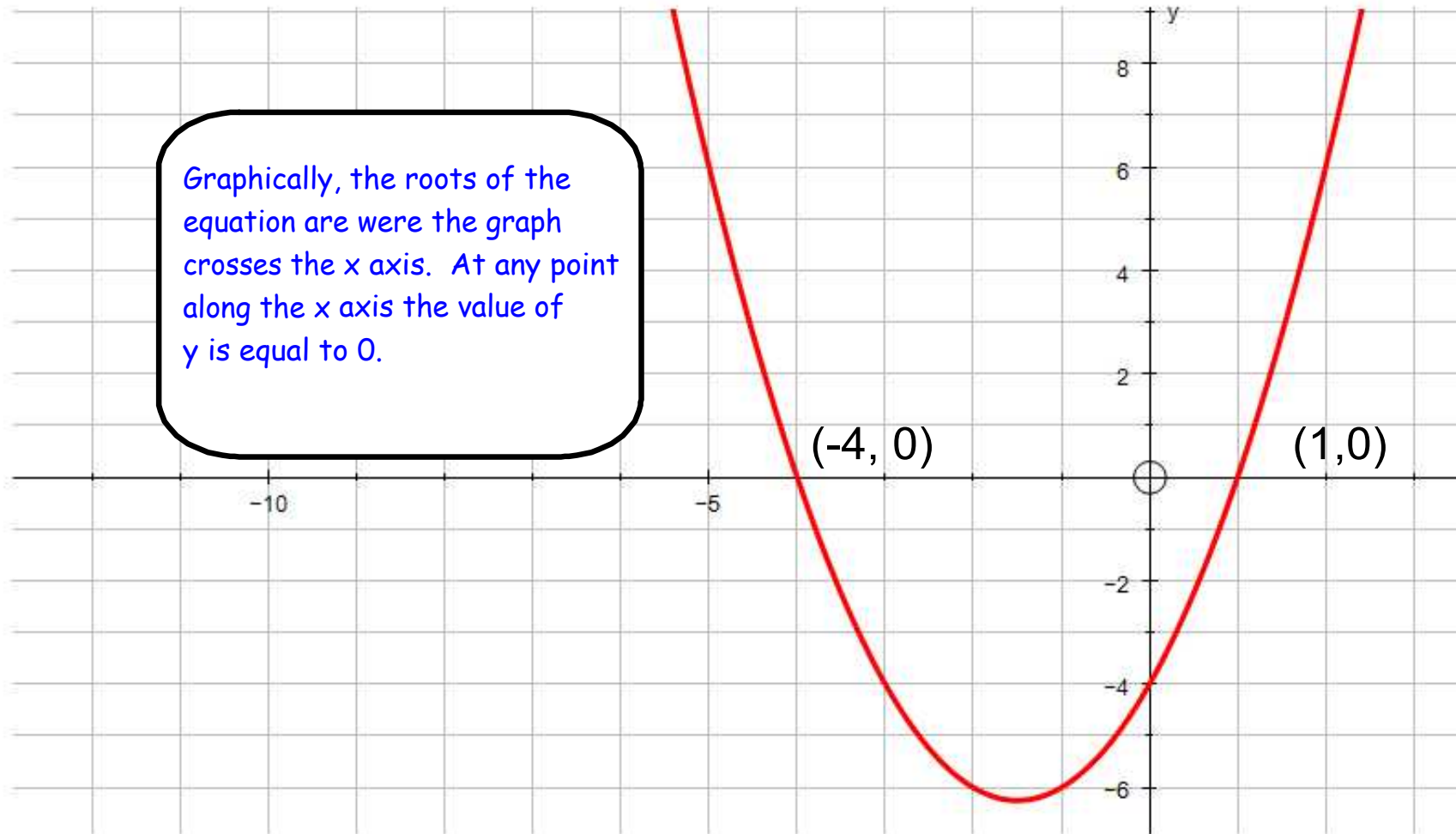
- **Solve $x^2 + 3x - 4 = 0$**

This quadratic happens to factor:

$$x^2 + 3x - 4 = (x + 4)(x - 1) = 0$$

...so I already know that the solutions are $x = -4$ and $x = 1$. How would my solution look in the Quadratic Formula? Using $a = 1$, $b = 3$, and $c = -4$, my solution looks like this:

$$x = \frac{-(3) \pm \sqrt{(3)^2 - 4(1)(-4)}}{2(1)}$$

$$= \frac{-3 \pm \sqrt{9 + 16}}{2} = \frac{-3 \pm \sqrt{25}}{2}$$

$$= \frac{-3 \pm 5}{2} = \frac{-3 - 5}{2}, \frac{-3 + 5}{2}$$

$$= \frac{-8}{2}, \frac{2}{2} = -4, 1 = x$$

Then, as expected, the solution is $x = -4$, $x = 1$.

Graphically, the roots of the equation are were the graph crosses the x axis. At any point along the x axis the value of y is equal to 0.

(-4, 0)

(1,0)

Example 1: $y = ax^2 + x3 - 4$

?

Steps for solving a quadratic equation

1) Identify a value for a
2) Identify a value for b
3) Identify a value of c
4) calculate b^2 - 4ac
5) calculate $\dfrac{-b + \sqrt{(b^2 - 4ac)}}{2a}$

6) calculate $\dfrac{-b - \sqrt{(b^2 - 4ac)}}{2a}$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Version 1 of the QUAD1 Program

Objective: Write a program named QUAD1 that will prompt
the user for the values of A, B, and C to be used
for calculating the roots of a quadratic equation,
and verify that the program has received the
values by telling the user the values that were
received.

This will demonstrate the following key components of
program development:

1) That you are able to create a program
2) That you are able to accept user input
3) That you are able to send the user some output
4) That you are able to run (or execute) a program that
you created.

These are valuable first steps for developing programs in any
programming language, on any computing platform.
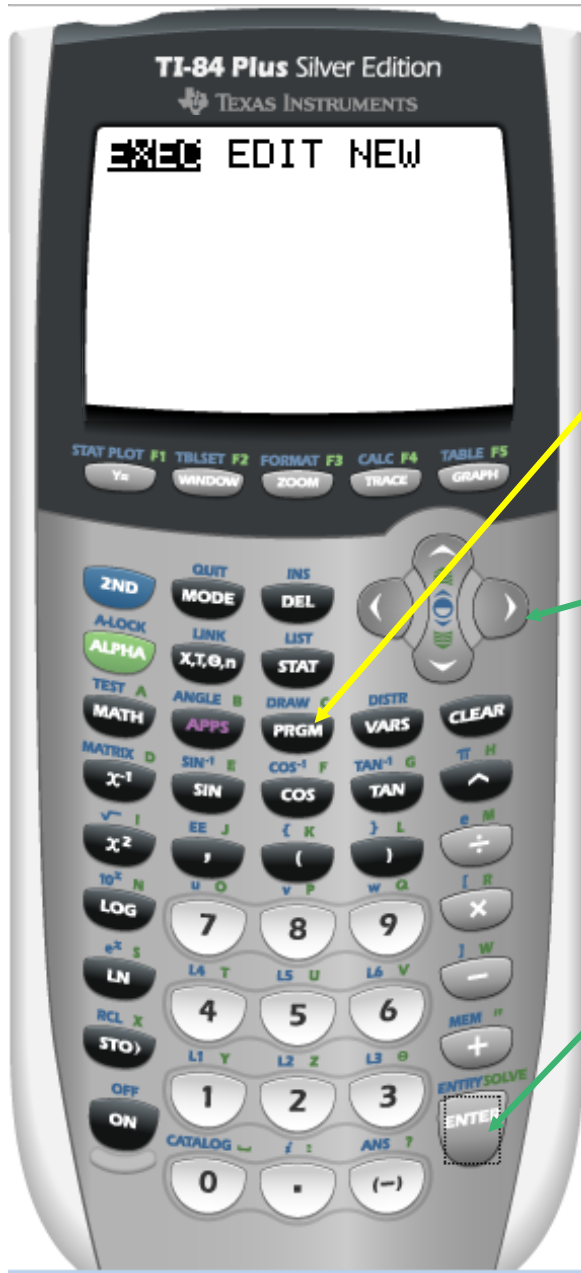
To create, edit, or execute a program, press the

PRGM key.

Select NEW
you can use the cursor
arrow keys to highlight NEW
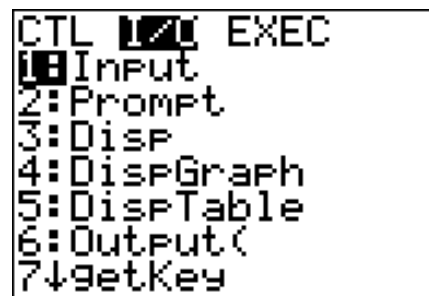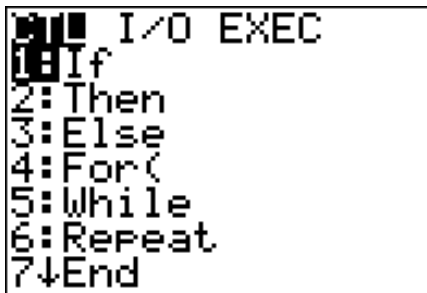and the press ENTER.

You will be prompted
to enter a name for
your new program,
name it QUAD1.
Alphabetic characters
are found in green
above many keys.
The Q is above the
9 key.

```
PROGRAM:QUAD1
:█
```

After entering the name QUAD1 you will be taken to a screen where you can begin to enter your program. A program is a sequence of statements that will tell the calculator what to do. In addition to all other calculator functions that you use regularly there are functions (or commands) that you can use to help you write programs.

When you are in edit mode, shown above, when you press the

DRAW C
PRGM

key you will see three selections available from the top menu

```
CTL  I/O  EXEC
1:If
2:Then
3:Else
4:For(
5:While
6:Repeat
7↓End
```

```
CTL  I/O  EXEC
1:Input
2:Prompt
3:Disp
4:DispGraph
5:DispTable
6:Output(
7↓getKey
```

```
CTL  I/O  EXEC
1:QUAD1
```

Use the arrow keys and select   I/O

```
CTL I/O EXEC
1:Input
2:Prompt
3:Disp
4:DispGraph
5:DispTable
6:Output(
7↓getKey
```

Select 2:Prompt
this will be used to prompt the user
for three values A, B, and C.

Note: You can use the arrow keys in
a menu to scroll down to highlight
the item you want to select - and
then press ENTER or you can press
or you can the number next to your selection.
In this key-press-history you can see that I
pressed the 2 key to select Disp,

```
PROGRAM:QUAD1
:Prompt
```

```
PROGRAM:QUAD1
:Prompt A,B,C■
```

PRGM ⟩ 2 ALPHA MATH , ALPHA

APPS , ALPHA PRGM
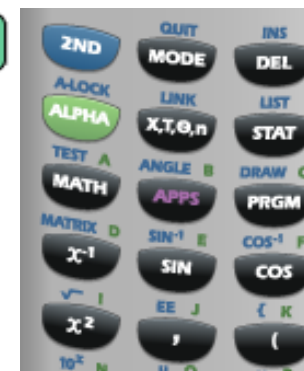
Here I told the Prompt command
to get three values for the user
and put them in variables A, B, and C.
The prompt command takes a list of parameters separated by commas.

```
PROGRAM:QUAD1
:Prompt A,B,C
:Disp
```

Next, we want our program to show the user the values that they had typed in. We will use the Disp command to do this. Disp is also found in the I/O menu.

```
PROGRAM:QUAD1
:Prompt A,B,C
:Disp "USER ENTE
RED: ",A,B,C
:■
```

The Disp command will show a list of items to the user. In this program we will show the user four items.

    A string that says USER ENTERED:

    The first number they entered A

    The second number they entered B

    The third number they entered C

The list of items to display to the user will be separated by commas. The string to be displayed must be in " " so that it is treated as a single item to be displayed.

:Disp "USER ENTERED: ", A,B,C

This will wrap to two lines in the calculator display, as shown.

Version 1 of the QUAD1 program is ready to be tested.

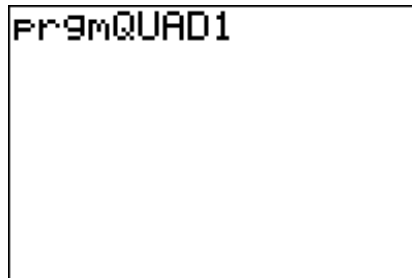Quit out of program mode and go back to the main calculator screen.

```
EXEC EDIT NEW
1 QUAD1
```

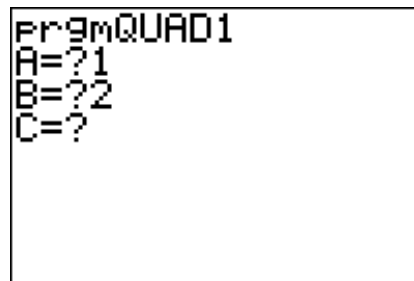To EXECute the QUAD1 program use the **PRGM** key. The PRGM menu that will be displayed and EXEC will already be highlighted. Select the QUAD1 program to execute. Here there is only one program, so QUAD1 is already highlighted.

```
PrgmQUAD1
```

After selecting QUAD1, press [ENTER] to execute the program.

```
PrgmQUAD1
A=?1
B=?2
C=?
```

Enter values as you are prompted

```
B=?2
C=?3
USER ENTERED:
                1
                2
                3
            Done
```

```
prgmQUAD1
A=?1
B=?2
C=?
```

```
B=?2
C=?3
USER ENTERED:
                    1
                    2
                    3
          Done
```

As you can see, I entered

1

2

3

as I was prompted for A, B, and C.

The Prompt command prompted me for each of A, B, and C one at a time even though they were listed in the program on the same Prompt statement.

The program executes the first line of the program, and I entered the three values as I was prompted. Then the program executes the second line of the program - notice that the string message appears on the left side of the screen and each number appears on its own line right justified on the screen. The calculator displayed the message "Done" to say the program has finished executing, that was not a message from the program we wrote.