

Programming the Quadratic Formula into a TI-83/84+ Calculator

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Once you know the quadratic formula, you can save time computing the roots (zeros) of quadratic polynomials by programming it into your Texas Instruments (TI) graphing calculator once-and-for-all.

To create a new program in your TI-83/84+, press **PRGM**, navigate over to the **NEW** menu, and select **Create New**. You'll be asked to name your new program; the one in this guide is named **QUAD**, but you can name yours whatever you want. Once you enter the name you should see a Program Editor screen like this where you'll write the program. That lonely colon **:** indicates the beginning of a line of code.



PROGRAM: QUAD
:

TI-83+ Screenshot: the QUAD program, empty for now.

If you exit the Program Editor screen you can return to it by pressing **PRGM**, navigating over to the **EDIT** menu, and selecting your program.

Given a quadratic polynomial $ax^2 + bx + c$ your program will need to do three things: first *prompt* you to input the coefficients a and b and c , then calculate the roots using the quadratic formula, and then *display* those roots.

1. Prompting for the Coefficients · While in the Program Editor, pressing **PRGM** will present you with menus of programming-related keywords. We're interested in input/output keywords, so press **PRGM** and navigate over to the **I/O** menu. Select **Prompt** and enter **Prompt A,B,C** as the first line of your program. Now when the program is executed, it will prompt for values of A and B and C to be entered. Note that the comma **,** button is above the **7** button.

2. Calculating the Roots · The roots x of a quadratic polynomial are

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

It'll make for a cleaner program if you only compute that square root once, and store it to a variable, say D .

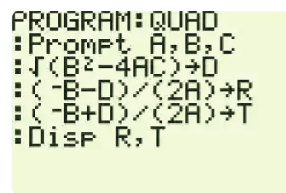
$$x = \frac{-b \pm D}{2a} \quad \text{where } D = \sqrt{b^2 - 4ac}$$

The syntax for storing this value to D is $\sqrt{(B^2-4AC)} \rightarrow D$, where you can enter that arrow \rightarrow by pressing the **STO \rightarrow** button. It will also be convenient to calculate then store the two roots to variables. We'll store the first root to R and the other root to T , which stand for "Root" and

"The other root" respectively. Do this with the lines $(-B-D)/(2A) \rightarrow R$ and $(-B+D)/(2A) \rightarrow T$.

3. Displaying the Roots · Finally to display the roots, return to the menu of input/output keywords by pressing **PRGM** and selecting the **I/O** menu. Select **Disp** then enter the line **Disp R,T** to *display* the roots.

Once finished your program should look like this:



```
PROGRAM: QUAD
: Prompt A,B,C
: √(B²-4AC)→D
: (-B-D)/(2A)→R
: (-B+D)/(2A)→T
: Disp R,T
```

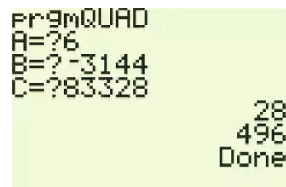
TI-83+ Screenshot: the QUAD program

```
: Prompt A,B,C
: √(B²-4AC)→D
: (-B-D)/(2A)→R
: (-B+D)/(2A)→T
: Disp R,T
```

To finish up, you should test your program on a quadratic polynomial with roots that you know to make sure you've entered the code correctly. To run your freshly written program, press **PRGM** and find **QUAD** under the **EXEC** menu. Selecting it will show **prgmQUAD** on the home screen; press **ENTER** to run **prgmQUAD**. Referring to the quadratic polynomial

$$6(x - 28)(x - 496) = 6x^2 - 3144x + 83328$$

enter $A = 6$, $B = -3144$, and $C = 83328$.



```
prgmQUAD
A=?6
B=?-3144
C=?83328

28
496
Done
```

TI-83+ Screenshot: testing the QUAD program

Delightful! Note that if you ever run this program and receive the error **ERR:NONREAL ANS**, this indicates that the roots of the quadratic are not real. I.e. $ax^2 + bx + c$ does not factor over the real numbers. If you'd like change the mode of your calculator to display complex numbers rather than report an error, press **MODE** and select **a+bi**.

For more information on programming in your TI calculator, consult the programming section in your calculator's guidebook.