Solving the Quadratic: My First TI-Nspire Program

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TI-Nspire offers two options for creating mathematical tools ourselves: functions and programs. Sometimes it can be hard to tell the difference, but essentially, functions must output (or "Return") something – whether that is a number, a list, an algebraic expression... even text. Programs can output all of these things too – or nothing at all! (when you just see "Done"). Only functions can be used outside the Calculator - such as in the spreadsheet or even Graphs & Geometry: programs do not work outside the Calculator. Finally, functions only work with local variables – they leave nothing behind. This can be a good thing, but sometimes you may need to leave a variable or list behind after running your routine – if so then you need a program.

We could simply create a function to solve our quadratic:

Define quad(a,b,c) = (-b-sqrt(b^2-4*a*c))/(2*a)

but this has a couple of problems: it can only give us one of the two possible solutions, and it does not distinguish the three cases: no solutions, 1 solution (or two equal solutions, if you like) and two distinct solutions.

We could get around this by getting it to give us a list of two items:

Define quad(a,b,c)={((−b-sqrt(b^(2)-4*a*c))/(2*a)),((−b+sqrt(b^(2)-4*a*c))/(2*a))}

This is pretty cool, but if we put in, say **quad(1,2,3)** we will get an error. We really need an "IF" statement in there to test and output something appropriate. We can do this with a function and leave a list of our solutions behind that can be ready in G&G or L&S.

So let's go with a function.

Open a Calculator page, choose the **Functions and Programs** menu, then **Program Editor: New**

Enter a name for your program, such as "QuadSolver". By default it is set to create a Program – change this to Function.

You could also set the Library Access here: if we choose LibPub, then our program will be included in the Catalog. If we drop this document into the MyLib folder, then we could actually call our program from other documents using the Catalog.
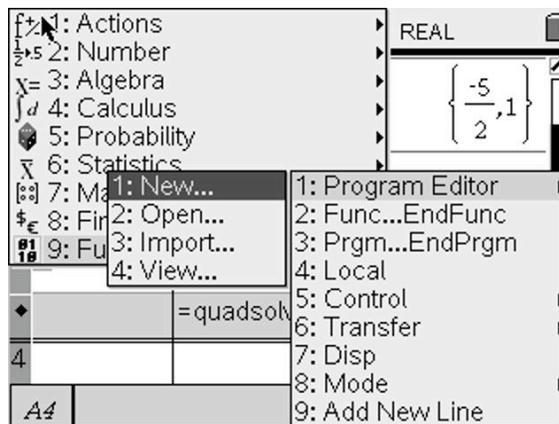
LibPriv means that it is not visible from the Catalog, but if we know it is there, we can still call it. For the moment, just leave the Library Access blank, to keep things simple.
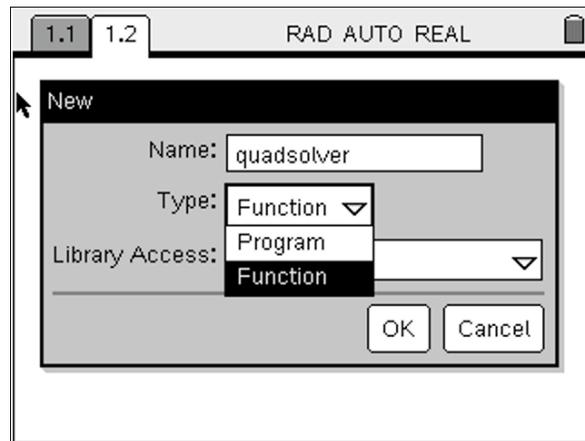
Now enter the inputs for this function - in this case, we will use a, b and c. When using TI-Nspire CAS, the inputs can also be algebraic expressions. For this function, we will introduce another variable, call it "discr" which will be the discriminant. Since we don't need this variable to exist after we complete our function, we define it as Local: **Local discr**
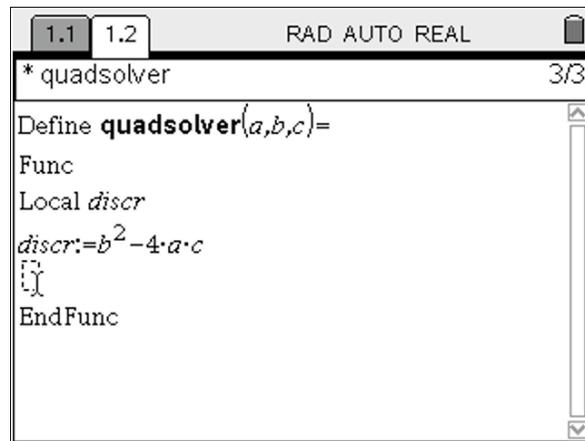
Now define this value, using either "Define discr =..." or, as shown here, the ":=" symbol. **Use CTRL-B to Check Syntax and Store.**

Time for our "IF" statement: there are two possibilities: if our discriminant is less than 0, then there are no real solutions; otherwise, we get either one or two solutions. From the IF menu, we should choose If...Then...Else...EndIf.
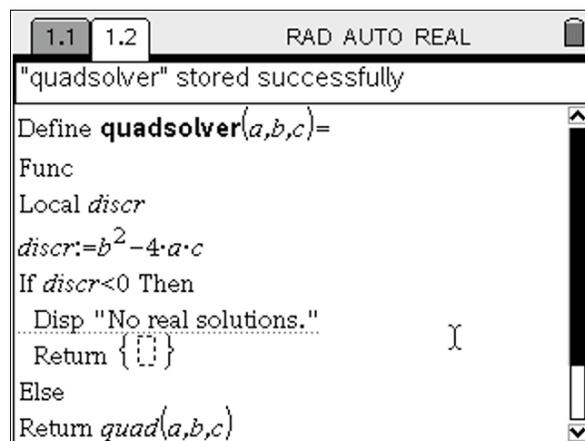
Using the "Disp" (Display) command, the first part is easy (Note we may then return the empty set), and why not use the function we have already defined rather than redo all that work for the second part of the condition?

[By the way, if we wanted to Display more than one thing on a line, just put a comma between the items!]

Once again, CTRL-B to check and store. Our function will either return a message and an empty set, or a set of solutions to the quadratic function set.

If we are using CAS, then we have one more option – to write a routine that accepts as input the actual quadratic function itself.

Define a new function as shown, using the Catalog command "PolyCoeffs" to list the coefficients, store each as a, b and c, and then call

```
"myquad" stored successfully
Define LibPub myquad(fn)=
Func
Local coef,a,b,c
coef:=polyCoeffs(fn)
a:=coef[1]
b:=coef[2]
c:=coef[3]
Return quadsolver(a,b,c)
EndFunc
```

This is probably the most useful form of the three functions that we have defined, so we might choose to define this as a Public function – saving the document and storing it in the MyLib folder will mean that this function is accessible from any other document using the Catalog.

If we then changed the Library access of the **quad** and **quadsolver** functions to LibPriv, then these too may be accessed from other documents as long as the name and path are known.

$$quads\backslash myquad\left(2 \cdot x^2 - 3 \cdot x - 5\right) \qquad \left\{-1, \dfrac{5}{2}\right\}$$

$$quads\backslash quadsolver(2,-3,-5) \qquad \left\{-1, \dfrac{5}{2}\right\}$$

$$quads\backslash quad(2,-3,-5) \qquad \left\{-1, \dfrac{5}{2}\right\}$$

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