A Rose For You

In this short article, we discuss how to use the HP Prime Advanced Graphing app to teach students about transformations in the plane, including translations and reflections. But instead of a geometric approach, the app allows us to take an algebraic approach. We start with a generic shape, which we then transform in various ways to build a picture of a rose.

We start by defining our generic shape, a filled ellipse, given by $x^2 + y^2 - x \cdot y - 1 < 0$.

- Press [Apps Info] and tap the *Advanced Graphing* icon
- Enter the expression above into V1, using [X] and [Y] to help you
- Tap on the color picker for V1 and choose purple

Press [Plot Setup] to see the graph of our ellipse. Press [+ Ans] to zoom in. This is the first "petal" of our rose.
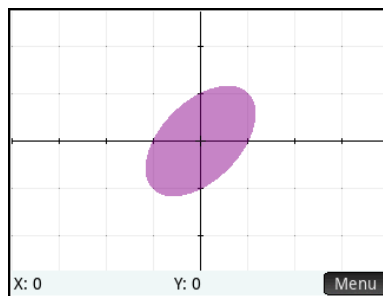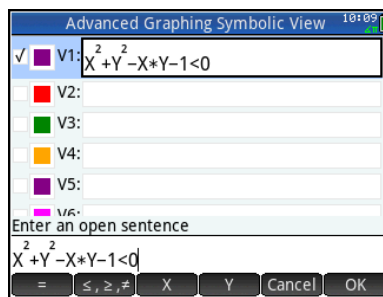
A reflection over the vertical line x=-1 is a mapping such that $x \rightarrow$ -2-x and $y \rightarrow y$. So we define V2 to be V1(-2-x, y), as shown in the figure to the right. We use the same color (purple) for our reflection.
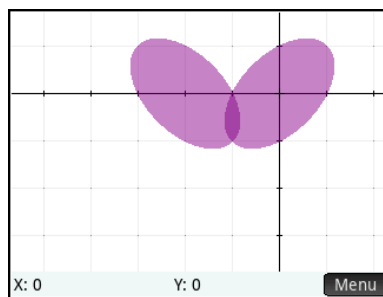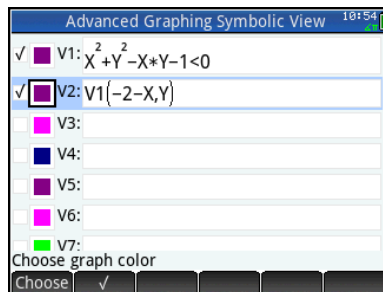
Press [Plot Setup] to see the second "petal"; tap and drag to scroll the view.

We need a stem for our rose. Creating a stem takes some experimentation. Students will learn to stretch the base shape first, then translate it into its final position. We defined V3 to be V1(10*(X+1),0.3*(Y+4)), as shown to the right. Do not forget to change the color to dark green!
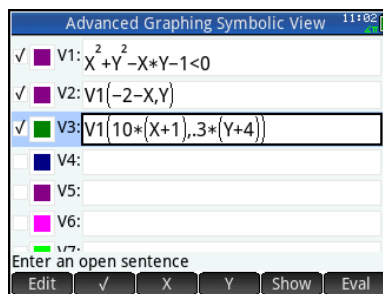
Again, press ⬚ to see the rose starting to take shape. Press ⬚ to zoom out and drag to scroll until you get the view you want.
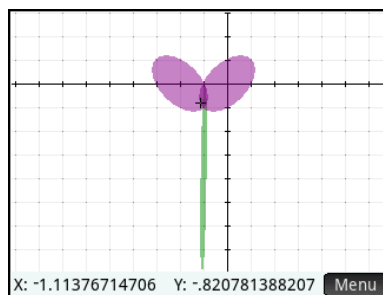
Next, we add some leaves. For the first leaf (in V4), we experiment as we did for the stem, first dilating and then translating to get what we want. Then the second leaf is the reflection of the first leaf, using the same method we used for the petals. We chose light green as the color for both leaves.
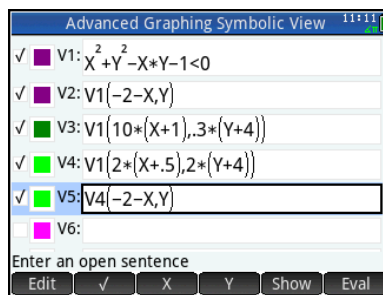
And now you have a simple rose!
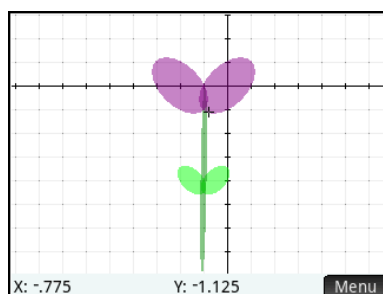
For extra credit, we added two fancy petals and some thorns. The expressions are shown on the next page in case you want to work them out for yourself first!
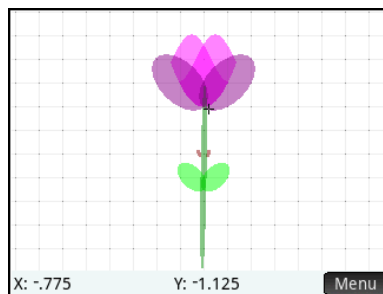
Be sure to save your new app. Press ⬚ to go to the App Library; the Advanced Graphing app should already be highlighted. Tap Save , enter a name for your new app (we used ARose4You), and tap OK twice. The new app now appears in your App Library.

Getting the most out of your HP Prime Virtual Calculator for the PC

If you are using the HP Virtual Prime for the PC (it is on the product CD that came with your HP Prime), you can just copy and paste the expressions below into the virtual calculator. Then you can send the app from the virtual calculator to your physical HP Prime. The steps are listed below.

Advanced Graphing app expressions for the rose

V1: X^2+Y^2-X*Y-1<0
V2: V1(-2-X,Y)
V3: V1(10*(X+1),.3*(Y+4))
V4: V1(2*(X+.5),2*(Y+4))
V5: V4(-2-X,Y)
V6: Y+1>(X+1)^2 AND Y<1+COS(2*X+3)
V7: V6(-2-X,Y)
V8: V1(20*(X+.8),10*(Y+3))
V9: V8(-2-X,Y)

To copy the rose expressions to your HP Prime Virtual Calculator

1. Select and copy the expression named V1. Note: select and copy everything after "V1:"
2. On the HP Prime Virtual Calculator, go to the Rose app Symbolic view and select the field **V1**
3. In the menu bar, click on *Edit* and select *Paste*. The expression will be pasted into the V1 field.
4. Tap OK to accept the expression. It will now graph properly.
5. Repeat Steps 2-4 for the other expressions (V2-V9)

To send the Advanced Graphing app from your virtual calculator to a physical HP Prime

1. Connect your physical HP Prime to your PC using the USB cable
2. Turn on your HP Prime and launch the HP Prime Virtual Calculator for the PC
3. On the virtual Prime menu bar, click *Calculator*, then click *Connect To* and select your physical Prime
4. Go to the App Library, select the Rose app, and tap Send
5. The Rose app is now on your physical Prime and ready for viewing!