## Composite functions

The Function aplet is capable of dealing with composite functions such as $f(x+2)$ or $f(g(x))$ in its **SYMB** view. The **EVAL** and **SHOW** keys are particularly helpful with this.

For example, if we define $F1(x) = x^2 - 1$ and $F2(x) = \sqrt{x}$, then we can use these in our defining of **F3(X)**, **F4(X)**. See the screen shot on the left below.

If the highlight is now positioned on each of these in turn, and the **EVAL** key pressed then the substitution is performed. The result is shown in the right hand snapshot.
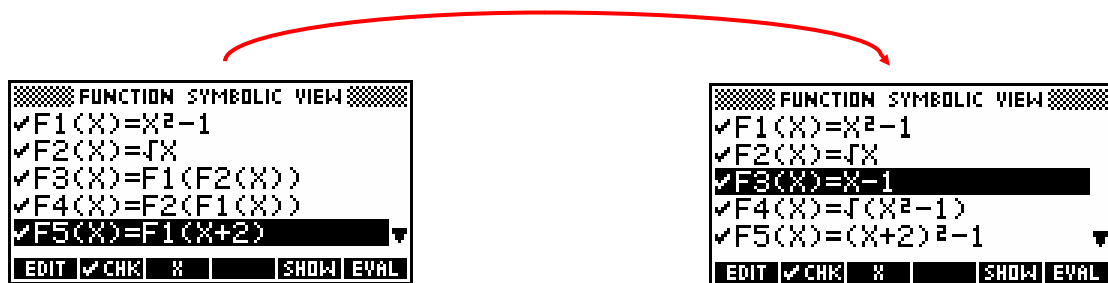
Notice that the calculator is smart enough to realize in **F3(X)** that $\left(\sqrt{x}\right)^2 - 1$ is the same as $x - 1$, although not, unfortunately, smart enough to keep track of the implications for the domain, which are that **F3(X)** should be defined only for non-negative x.

There is a limit to this however. If you define $F1(x) = x^2 - x - 1$ and then $F2(x) = F1(x+1)$, then the **EVAL** routine will not simplify $(x+1)^2 - (x+1) - 1$ to $x^2 + x - 1$.

On the other hand there is a way to further simplify the expression. **EDIT** the result and enclose it with the **POLYFORM** function as shown right, adding a final '**,X**' as shown, then highlight it and press **EVAL**. The calculator will expand the brackets and gather terms.
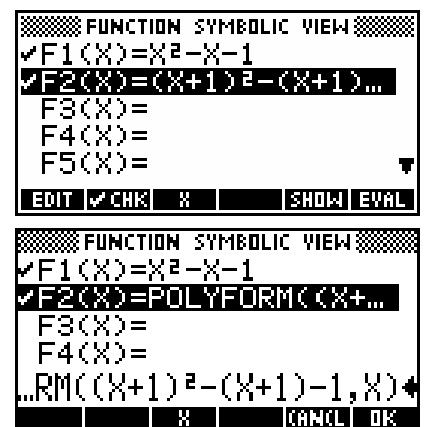
> **Calculator Tip**
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> These functions can all be graphed but the speed of graphing is slowed if you don't press **EVAL** first. This is because the *composite* function is internally re-evaluated for each point graphed. The hp 39gs and hp 40gs are fast enough that the result is still satisfactory but if you have an old 39g or 40g they are slowed to the point of being unusable.

Evaluating the function may also hide the domain and for this reason it is sometimes best to leave the evaluation undone.

For example, if $F1(X) = X^2$ and $F2(X) = \sqrt{X}$ then $F3(X) = F1(F2(X))$ will show the correct domain of $x \geq 0$ for both **F2(X)** and **F3(X)** in the **NUM** view. Pressing **EVAL** will destroy this.

X	F1	F2	F3
-.3	.09	UNDEF.	UNDEF.
-.2	.04	UNDEF.	UNDEF.
-.1	.01	UNDEF.	UNDEF.
0	0	0	0
.1	.01	.3162278	.1
.2	.04	.4472136	.2

-.3

| ZOOM | | | BIG | DEFN | |