Complex numbers and the TI-89

Look for the i key as the 2nd of CATALOG. There are two modes you have to have set when working with complex numbers. The first mode is, as always, degree or radian. The second is the form of the complex number, or "**Complex Format**" in the MODE menu. The useful options are: 2. RECTANGULAR (actually a + bi form), and 3. POLAR (a version of trig form.)

Changing from trig form to a + bi form

There are 2 options, but you have to be careful about mode. You need to be in RECTANGULAR Complex Format for this operation to be simple.

Option 1: Write the trig form of the number, then hit ENTER.

Example: Write "2(cos (45) + i sin (45))", hit ENTER. Result: $\sqrt{2} + \sqrt{2}\,i$.

If not in degree mode, you need to add the degree symbol, i.e. 45E.

Option 2: Note the p key, the 2nd of EE in the first column.

If you enter (r p θ), the calculator interprets this as r(cos θ + i sin θ)

Example: Write "(2 p45)", hit ENTER. Result: $\sqrt{2} + \sqrt{2}\,i$.

Option 2 is less intuitive, but involves a lot less button-punching.

Changing from a + bi form to trig form

Regardless of the mode or format, the machine won't put a complex number into simple trig form. Some interpretation is required. Let's consider 2 + 2i, which equals $2\sqrt{2}$ (cos 45E + *i* sin 45E). Put the machine in POLAR Complex Format.

In degree mode write "2 + 2i", hit ENTER. Result: $(2\angle\sqrt{2}$ p 45).

Change to radian mode, hit ENTER. Result: $e^{\frac{i\pi}{4}}\cdot 2\sqrt{2}$

It is your job to rewrite your calculator's spew in the proper form, $2\sqrt{2}$ (cos 45E + *i* sin 45E). You can, of course, use $\pi/4$ for 45E.

Example: Express $\sqrt{5}$ cis $\left[\tan^{-1}\left(-\frac{1}{2}\right)\right]$ in a + bi form.

Enter " $(\sqrt{(5)}$ p $\tan^{-1}(-.5))$".

You shouldn't be in polar format for this operation, but if you are in polar degree mode, when you hit ENTER you get (2.236 p -26.565).

If you are in polar radian mode, you get $e^{-.463647i}\cdot 2.236$. Note that $\sqrt{5}$. 2.236. What are -26.565 and -.463647?

The right mode for this problem is rectangular. Then in degree or radian mode, you get "2. -i", or 2 - i.