Complex Numbers

This resource sheet is designed for use with the Casio fx-CG20. However it can be used with the Casio fx-9860GII or the Casio fx-9750GII although there may be some differences in the key sequences needed and in the screen displays.

Aim

This activity introduces the complex number functions on the calculator and how it might be used by students to investigate some of the properties of complex numbers

Activity

Go to the menu and select RUN [MENU] [1] . Then press [EXE]

We need to start by setting up the calculator to operate with complex numbers. Go to SET UP [SHIFT] [MENU] and scroll down to 'Complex Mode'.

Select the **'a+bi'** option by pressing [F2]

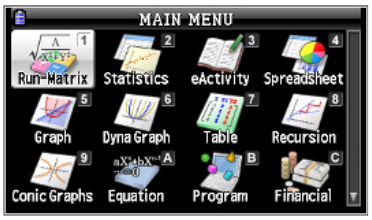
Get back to the main screen by pressing [EXIT]

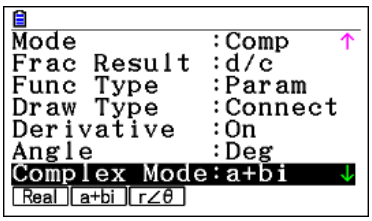
Now press [OPTN] [F3] to bring up the complex operations menu. You will see that there are now options to select:

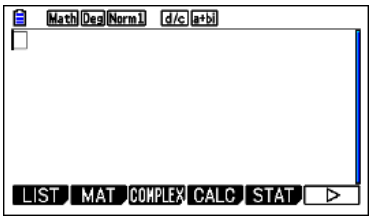
- **i** to input **i** on the screen
- **Abs** finds the modulus of the complex number
- **Arg** finds the argument of the complex number
- **Conj** finds the complex conjugate

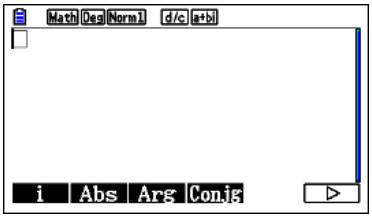
And scrolling across by pressing ▷ [F6]

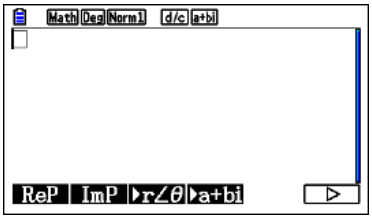
- **ReP** finds the real part of a complex number
- **ImP** finds the imaginary part of a complex number
- **►r∠θ** converts the result to polar form
- **►a+bi** converts the number to rectangular form











Complex Numbers

The calculator will perform all the usual operations on complex numbers.

Hint: It is usually best to put complex numbers in brackets.
For example, if you want to find the modulus of 3 + 4i,
enter **abs**(3+4i) EXE

Hint: When finding the argument, θ, of a complex number the result depends on the angle setting in the SET UP screen.

If it is set to degrees, then θ will be in the range $-180 < \theta \leq 180$
If it is set to radians, then θ will be in the range $-\pi < \theta \leq \pi$

Try some out.

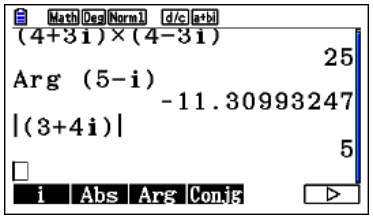
For example:

(4+3i) X(4 – 3i)

Or
Arg(5 – i)

Or
The absolute value of (3+4i)
This is shown on screen as $|(3+4i)|$

Try some out of your own.



Complex Numbers

Exercise

1. Simplify $(6 + 4i) – (2 – 3i)$
2. Simplify $(5 – 2i)(6 – i)$
3. Find the modulus of $3 – 3i$
4. Find the argument of $– 2 + 3i$
5. Find the modulus and argument of $2 – 7i$

You should now feel confident using the complex numbers facility on the calculator. Here are some investigations that will encourage your students to explore some more of the features of complex numbers using the graphics calculator.

Investigations

Investigation 1

If $z_1=12 +5i$ and $z_2 = 4 – 3i$

Find:

a) $| z_1 |$
b) $| z_2 |$
c) $| z_1 || z_2 |$
d) $| z_1 z_2 |$

What do you notice? Does this work for any complex numbers? Can you prove it?

Investigation 2

The complex conjugate of $a + bi$ is $a – bi$

Multiply $6 + 5i$ by its complex conjugate. What do you notice about the result?

Try some other complex numbers and do the same. Can you generalise this result?

Prove it!