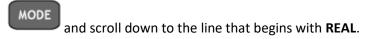# Complex Numbers in TI-83/84

Your calculator can do basic arithmetic using complex numbers.  To activate this feature, select

**MODE** and scroll down to the line that begins with **REAL**.

Scroll over to $a + bi$ and press **ENTER** .  When $a + bi$ is

highlighted, press **2nd** **MODE** for **QUIT** to return to the main screen.

```
MATHPRINT  CLASSIC
NORMAL  SCI   ENG
FLOAT  0 1 2 3 4 5 6 7 8 9
RADIAN  DEGREE
FUNCTION  PARAMETRIC  POLAR  SEQ
THICK DOT-THICK THIN DOT-THIN
SEQUENTIAL  SIMUL
REAL   a+bi  re^(θi)
FULL  HORIZONTAL   GRAPH-TABLE
FRACTION TYPE: n/d  Un/d
ANSWERS: AUTO   DEC   FRAC-APPROX
GO TO 2ND FORMAT GRAPH: NO   YES
STAT DIAGNOSTICS: OFF   ON
STAT WIZARDS: ON   OFF
SET CLOCK  12/23/16 9:22PM
```

Once turned on, you can leave it on as it will not affect operations on real numbers at all.

Let's try some examples.

Suppose I want to add $(4 + 3i) + (5 - 2i)$.
You can type the expression in exactly as it's written.  To

get $i$, press **2nd** **.** .

```
(4+3i)+(5-2i)
                            9+i
```

We can also perform operations like multiplication and powers.

Find the value of $(3 - i)^2 + (3 + i)$.

We can use this, and the ANS feature to find sequences of values of the Mandelbrot set.

```
(3-i)²+(3+i)
                          11-5i
```

Recall the formula defining the Mandelbrot set is given by $s_{N+1} = s_N^2 + s$.  Let's use the seed value $s = \frac{1}{2} - \frac{5}{6}i$.

Enter this value into the calculator.

```
1/2-5/6i
                  .5-.8333333333i
```

Since the formula is recursive, we are going to use the output value to obtain the new input value.  Press

**2nd** **(−)** (for **ANS**), then **x²** **+** and the original seed value $\frac{1}{2} - \frac{5}{6}i$.

Then just keep hitting **ENTER** to get your sequence. Each time the formula is calculated, it will use the answer you obtained at the last step.

We can see that this point is not in the Mandelbrot set since the values of the number keep getting bigger and bigger.

```
Ans²+1/2-5/6i
     .0555555556-1.666666667i
Ans²+1/2-5/6i
   -2.274691358-1.018518519i
Ans²+1/2-5/6i
    4.636840802+3.800297211i
Ans²+1/2-5/6i
       7.55803373+34.409413i
```