Imaginary Numbers

$i = \sqrt{-1}$

$\sqrt{-49} = 7i$

$i^1 = i$

$i^2 = \sqrt{-1} \cdot \sqrt{-1} = -1$

$i^3 = i^2 \cdot i^1 = -1 \cdot i = -i$

$i^4 = i^2 \cdot i^2 = -1 \cdot -1 = 1$

$i^5 = i^4 \cdot i^1 = 1 \cdot i^1 = i$

$i^6 = i^4 \cdot i^2 = 1 \cdot -1 = -1$

$i = i$ 0.25

$i^2 = -1$ 0.5

$i^3 = -i$ 0.75

$i^4 = 1$ 0.00

I won! I won!
(with 2 negatives in the middle)

$i^{15} = -i$

$i^{351} = i^3 = -i$

$87.75 = 87\frac{3}{4}$

$4 \overline{)351}$

87
32
31
28
3

$\frac{34}{4} = 8.5$ $\frac{165}{4} = 41.25$ $\frac{203}{4} = 50.75$

$3i^{34} - 2i^{165} + i^{203}$

$3(-1) - 2(i) + (-i)$

$= -3 - 2i + -i$

$= \boxed{-3 - 3i}$

$\sqrt{-6} \cdot \sqrt{-32} = \sqrt{192} = 8\sqrt{3}$

$16 \cdot 2$ $\quad 64 \cdot 3$

$i\sqrt{6} \cdot 4i\sqrt{2}$

$= 4i^2\sqrt{12}$ $\quad 4 \cdot 3$

$= 4(-1)(2\sqrt{3})$

$= -8\sqrt{3}$

Solve.

$3(x-4)^2 + 11 = -4$

$-11 \quad -11$

$\frac{3(x-4)^2}{3} = \frac{-15}{3}$

$\sqrt{(x-4)^2} = \sqrt{-5}$

$x - 4 = \pm i\sqrt{5}$

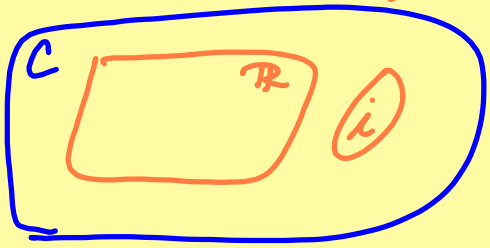
$\boxed{x = 4 \pm i\sqrt{5}}$

$4 + i\sqrt{5}, \; 4 - i\sqrt{5}$

Complex Numbers - [2 parts: real, imag.

$7 + 2i$ $\quad a + bi$

↑ real ↑ imag.



$5 - 6i$

$8 + 0i$

$0 - i\sqrt{3}$

Addition / Subtraction

$(5 + 3i) + (7 + 8i) = 12 + 11i$

$(9 - 6i) + (+3 + 4i) = 12 - 10i$

Multiplication/Division

$(6-8i)(5+2i)$ FOIL!

$= 30 + 12i - 40i + 16i^2$

$= 46 - 28i$

$(2-7i)^2 = (2-7i)(2-7i)$

$= 4 - 14i - 14i + 49i^2$

$= \boxed{-45 - 28i}$

$\frac{7+\sqrt{2}}{2\sqrt{3}} \cdot \frac{\sqrt{3}}{\sqrt{3}}$

$\frac{3+2i}{5i} \cdot \frac{i}{i}$

$\frac{3i+2i^2}{-5i^2}$

$= \boxed{\frac{-3i+2}{+5}}$

Conjugate Baby!

$\frac{4+2i}{3+5i} \cdot \frac{(3-5i)}{(3-5i)}$

$\frac{12-20i+6i+10i^2}{9+25i^2}$

$\frac{22-14i}{34}$

$= \boxed{\frac{11-7i}{17}}$

FRACTALS

Mandelbrot Set – 1980

$f(x) = x^2 + c$

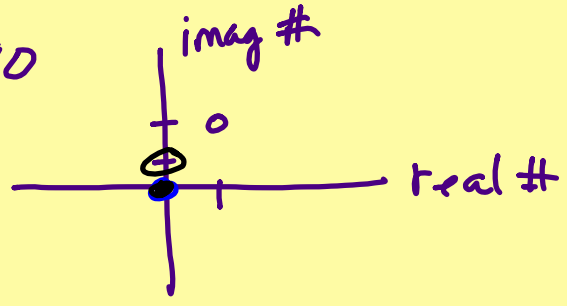
$f(x) = x^2 + 0 + i$

$f(0) = 0^2 + i = i$

$f(i) = i^2 + i = -1 + i$

$f(-1+i) = (-1+i)^2 + i = 3i$

$1 + 2i$



Iteration – find value of a function, repeatedly sub in the previous result

$f(x) = x^2 + (1+0i)$

$f(0) = 0^2 + 1 + 0i = 1$

$f(1) = 1^2 + 1 = 2$

$f(2) = 2^2 + 1 = 5$

$f(5) = 5^2 + 1 = 26$