October 15, 2021

Imaginary Numbers

$i = \sqrt{-1}$

$\sqrt{-64} = 8i$

$i^1 = i$

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

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

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

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

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

0.25 $i = i$

0.5 $i^2 = -1$

0.75 $i^3 = -i$

0.00 $i^4 = 1$

I won! I won! (With 2 negatives in middle)

$i^{23} = i^3 = -1$

i^{350} $\frac{350}{4} = 87.5 = \frac{2}{4}$

$= i^2 = -1$

$4\overline{)23}$ 5, -20, 3

$\frac{23}{4} = 5.75 = \frac{3}{4}$

$3i^{7.75} - 2i^{16.25} + i^{50.75}$

$3i^{31} - 2i^{65} + i^{203}$

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

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

$-3i - 2i - i$

$= -6i$

$\sqrt{-6} \cdot \sqrt{-32}$ (16·2)

$= 1i\sqrt{6} \cdot 4i\sqrt{2}$

$= 4i^2\sqrt{12}$ (9·3)

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

$= \boxed{-8\sqrt{3}}$

$3x^2 + 65 = 11$

$-65 \quad -65$

$\frac{3x^2}{3} = \frac{-54}{3}$

$\sqrt{x^2} = \sqrt{-18}$ (9·2)

$\boxed{x = \pm 3i\sqrt{2}}$

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Complex Numbers

have 2 parts

$a + bi$

↑ real ↑ imaginary

$7+2i$

$5-8i$

$6+0i$

$0-9i$

All numbers are ~~complex numbers~~!

Addition/Subtraction

$(7+3i)+(9-8i)=\boxed{16-5i}$

$(12-7i)+(+3+2i)=\boxed{15-5i}$

Multiplication

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

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

$= \boxed{46-28i}$

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

$= 4-14i-14i+49i^2$ ($i^2=-1$)

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

DIVISION

$$\frac{5}{2\sqrt{7}} \cdot \frac{\sqrt{7}}{\sqrt{7}} = \frac{5\sqrt{7}}{14}$$

$$\frac{8}{3i} \cdot \frac{i}{i} = \frac{8i}{3i^2} = -\frac{8i}{3}$$

$$\frac{2+3\sqrt{2}}{5-4\sqrt{2}} \quad (5+4\sqrt{2})$$

Conjugate

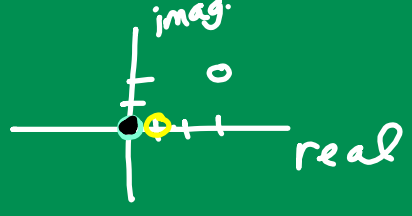
$$\frac{4+2i}{3+5i} \quad (3-5i)$$

FL

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

$$= \frac{22-14i}{34} = \boxed{\frac{11-7i}{17}}$$

FRACTALS



Benoit Mandelbrot
1980

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

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

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

$f(0) = 0$

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

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

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

$f(2) = 2^2 + 1 + 0i = 5$

$f(5) = 5^2 + 1 + 0i = 26$

$f(26) = 26^2 + 1 = 677$

Iteration = Sub the answer back into the function

Red	1-5	1,000,000
Orang	6-10	1,000,000

Self-similar