
Proof 1.5 — Mandelbrot and Julia Set Iteration Equations

The Mandelbrot and Julia iteration is:

$z_{n+1}=z_n^2+c$

Let $z_{n+1}=z_{n+1,\,a}+i\, z_{n+1,\,b}$ and $z_n=z_a+i\, z_b$ and $c=c_a+i\, c_b$.

Step 2: Squaring Z_n

$z_n^2=(z_a+i\, z_b)^2$

$Z_n^2 = z_a^2+(i\, z_b)^2+2*z_a*z_b\, i$

Since $i^2=-1$, this simplifies to:

$Z_n^2=z_a^2-z_b^2+2*z_a*z_b\, i$

Step 3: Adding c and z_n in equation $z_{n+1}=z_n^2+c$:

$z_{n+1}=z_a^2-z_b^2+2*z_a*z_b\, i+c_a+i\, c_b$

$Z_{n+1}=(z_a^2-z_b^2+c_a)+i\,(2*z_a*z_b+c_b)$

Step 4: Separating real and imaginary parts:

$z_{n+1,\,a}=z_a^2-z_b^2+c_a$

$z_{n+1,\,b}=2*z_a*z_b+c_b$

Code Equivalent:

z_n=z_a+z_b; z_{n+1}=zn_a+zn_b; c=c_a+c_b;

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// Mandelbrot iteration step
double zn_a = (z_a * z_a) - (z_b * z_b) + c_a;
double zn_b = 2 * (z_a * z_b) + c_b;
z_a = zn_a;          // Making real part of zn+1=zn
z_b = zn_b;          // Making imaginary part of zn+1=zn
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Note: In Mandel Brot c varies in Julia z