
Proof 1.2 – Distance Formula in the Complex Plane ($c_a * c_a$) + ($c_b * c_b$) > 4

$c = c_a + i\, c_b$

The distance of a complex number from the origin is given by the modulus:

$|c| = \text{sqrt}\ (c_a^2 + c_b^2)$

The Mandelbrot condition requires that if

$|c| > 2$ (Proof in 1.1)

then c cannot belong to the set.

So:

$|c| > 2$

$\Leftrightarrow \text{sqrt}\ (c_a^2 + c_b^2) > 2$

$\Leftrightarrow c_a^2 + c_b^2 > 4$

This avoids the square root, making the check faster in code.

Code Equivalent

Distance test: for c = c_a + i*c_b, |c| = sqrt (c_a * c_a+ c_b* c_b).

If |c| > 2 then c cannot be in the Mandelbrot set.

Squaring both sides gives: (c_a*c_a) + (c_b*c_b) > 4
