The Mandelbrot Set and its Variations

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Abstract

The Mandelbrot set is a set of complex numbers, numbers that are
the sum of real and imaginary numbers. Complex numbers are shown on
the complex plane which is the equivalent of a 2-dimensional real number
line.

1   Imaginary Numbers

Imaginary numbers are all the numbers who have negetive real squares. Examples of imaginary numbers include $\sqrt{-1}$, $\sqrt{-25}$, $-\sqrt{-1}$, $\sqrt{-\sqrt{2}}$ and $\sqrt{-x}$ for any positive reals x.

We define i to be the imaginary number such that $i^2 = -1$. Notice that no real i could satisfy this property.

All imaginary numbers can be written as a real number multiplied by i. For example $\sqrt{-1} = i$ as $i^2 = -1$, $\sqrt{-25} = 5i$ as $(5i)^2 = 25i^2 = -25$, $-\sqrt{-1} = -i$, $\sqrt{-\sqrt{2}} = \sqrt{\sqrt{2}}i = \sqrt[4]{2}$ and $\sqrt{-x} = \sqrt{x}i$ for any positive reals x.