

# Multivalued Function

A multivalued function, also known as a multiple-valued function (Knopp 1996, part 1 p. 103), is a "function" that assumes two or more distinct values in its **range** for at least one point in its **domain**. While these "functions" are not **functions** in the normal sense of being **one-to-one** or **many-to-one**, the usage is so common that there is no way to dislodge it. When considering multivalued functions, it is therefore necessary to refer to usual "functions" as **single-valued functions**.

While the **trigonometric**, **hyperbolic**, **exponential**, and integer **power** functions are all **single-valued functions**, their inverses are multivalued. For example, the function  $z^2$  maps each complex number  $z$  to a well-defined number  $z^2$ , while its **inverse function**  $\sqrt{z}$  maps, for example, the value  $z = 1$  to  $\sqrt{1} = \pm 1$ . While a unique **principal value** can be chosen for such functions (in this case, the **principal square root** is the positive one), the choices cannot be made **continuous** over the whole **complex plane**. Instead, lines of **discontinuity** must occur.

# Iterations Of Multivalued Functions

**Michael Carey**



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