

Real, Complex and Quaternion fields	
Function signature	Description
floor(x) qfloor(x) frac(x)	If x is a real number, floor(x) or qfloor(x) is the greatest integer $\leq x$ . In mathematics, it is often denoted $\lfloor x \rfloor$ .
ceiling(x) qceiling(n,m) ceil = ceiling	If x is a real number, ceiling(x) is the least integer $\geq x$ . Since it relies on the Python double precision floats, it is not indicated when higher precision is needed. An alternative is qceiling(n,m), n and m integers, m $\neq 0$ , which returns the (exact) ceiling of the rational number n/m.
lies(x,a,b) lies(x)	It returns 1 iff $a < x < b$ . By default a = 0 and b = 1.
entropy(x,q) entropy(x)	It computes the q-ary entropy of x. By default q = 2.
polar(r,a) polar(r,a,phi,theta)	polar(r,a) returns the complex number $r \cdot \cos(a) + i \cdot r \cdot \sin(a)$ polar(r,a,phi,theta) returns the quaternion with norm r, real part a/r and axis angle given by the versor(phi,theta).
versor(phi) versor(phi,theta)	versor(phi) returns the complex number of norm 1 that is represented by the vector $\cos(\theta) + i \cdot \sin(\theta)$ versor(phi,theta) returns the quaternion number defined by $\cos(\theta) \cdot \mathbf{i}_1 + \sin(\theta) \cdot \sin(\phi) \cdot \mathbf{i}_2 + \cos(\phi) \cdot \sin(\phi) \cdot \mathbf{i}_3$
quat(*l)	quat(*l) returns the quaternion with components in the list l. It can also be called by giving 4 numbers.
length(a) amplitude(a) conjugate(a)	Given a complex number or a quaternion, it returns its length (norm), amplitude (squared norm) and conjugate.
Re(Z) Im(Z)	Re(Z) returns the real part of the complex number Z. Im(Z) returns the imaginary part of the complex number Z.
cx(P)	Given the pair of numbers [P[0],P[1]], it returns the complex number with real part P[0] and imaginary part P[1].
ang(x,y)	Given 2 vectors x and y, it returns the angle between them.
vang(A,B,C)	Given 3 points A,B and C, it returns the angle between the vectors AB and AC
i_	It represents the imaginary unit in the complex numbers.
i1_ i2_ i3_	They represent the quaternion units.
HH_	Quaternion field.
CC_ = C_	Complex field