Fu Bar

Marvin Cohrs

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Contents

1 Skills

1.1 Operators + Functions

Fu Bar knows several operators and functions:

- Addition: $x + y$
  Adds two floating-point numbers.
  e.g. $4.1 + 5.8 = 9.9$
- Subtraction: $x - y$
  Subtracts a floating-point number from another one.
  e.g. $9.9 - 5.8 = 4.1$
- Multiplication: $x * y$
  Multiplies two floating-point numbers.
  e.g. $1.1 * 9.0 = 1.1 \times 9.0 = 9.9$
- Division: x/y
  Divides a floating-point number by another one.
  e.g. $9.9/1.1 = \frac{9.9}{1.1} = 9.0$
- Integer division: $n\backslash m$
  Divides an integer by another one and returns the integer quotient.
  e.g. $20\backslash 6 = 3$
  because $6 \times 3 = 18$ and $6 \times 4 = 21$

- Modulo: $n\#m$
  Divides an integer by another one and returns the modulo.
  e.g. $20\#6 = 2$
  because $6 \times 3 + 2 = 20$

- Exponentiation: $x\hat{}n$
  Exponentiates a floating-point base by an integer exponent.
  e.g. $2\hat{}8 = 2^8 = 256$

- Paranthenses: $(expression)$
  An expression in paranthenses has got a higher priority.
  e.g. $2 * (4 + 5) = 2 * 9 = 18$
  but $2 * 4 + 5 = 8 + 5 = 13$

- Absolute Value: $|expression|$, $abs(expression)$
  Gets the absolute value of an expression.
  e.g. $|+3| = 3$
  and $|-3| = 3$, too!

- Negation: $-x$, $neg(x)$
  Negates a floating-point number.
  e.g. $-(3 * 2) = -6$

- Reciprocal: $1/x$, $rec(x)$
  Divides $\frac{1}{x}$, resulting the reciprocal.
  e.g. $rec(4) = \frac{1}{4} = 0.25$

- Factorial: $n!$, $fac(n)$
  Computes the factorial of an integer.
  e.g. $4! = 24$

- Binomial Coefficient: k from n, $n\mathrm{C}k$
  Computes the binomial coefficient for $\binom{n}{k}$
  e.g. 2 from $3 = 3\mathrm{C}2 = \binom{3}{2} = 3$

- Square root: $sqrt(x)$, $SquareRoot(x)$
  Computes the square root of a floating-point number.
  e.g. $sqrt(9) = \sqrt{9} = 3$

- Cube root: $cbrt(x)$, $CubeRoot(x)$
  Computes the cube root of a floating-point number.
  e.g. $cbrt(27) = \sqrt[3]{27} = 3$

- nth root: $nrt(x; n)$, $Root(x; n)$
  Computes the nth root of a floating-point number.
  e.g. $nrt(4096; 6) = \sqrt[6]{4096} = 4$

- Integer reduction: $int(x)$, $x\backslash 1$
  Reduces a floating-point number to an integer:
  e.g. $int(tau) = 6$

- Cut: $frac(x)$
  Cut's the number at the floating-point, resulting fraction part.
  e.g. $frac(23.45) = 0.45$

- Binary conjunction: n and m
  Conjuncts two integers.
  e.g. 7 and $11 = 3$

- Binary disjunction: n or m
  Disjuncts two integers.
  e.g. 7 or $11 = 15$

- Binary contravalence: n xor m
  Contravalences two integers.
  e.g. 7 or $11 = 12$

- Greatest common divisor: $gcd(n; m)$
  Computes the greatest common divisor of two integers.
  e.g. $gcd(21; 28) = 7$

- Least common multiple: $lcm(n; m)$
  Computes the least common multiple of two integers.
  e.g. $lcm(3; 4) = 12$

- Sinus / Cosinus: $sin(x)$, $cos(x)$
  Computes the sinus / cosinus of an angle.
  Don't forget to specify the input unit (otherwise I'll use radians).
  The output unit is always radian.
  e.g. $sin(90\,\text{deg}) = \sin\frac{1}{4}\tau = 1$

- Conversions:
  - $rad(x$ deg): Degree ⇒ Radians
  - $rad(x$ grad): Gradian ⇒ Radians
  - $rad(x$ turn): τ-Radians ⇒ Radians
  - $deg(x$ [rad]): Radians ⇒ Degree
  - $deg(x$ grad): Gradian ⇒ Degree
  - $deg(x$ turn): τ-Radians ⇒ Degree
  - $grad(x$ [rad]): Radians ⇒ Gradian
  - $grad(x$ deg): Degree ⇒ Gradian
  - $grad(x$ turn): τ-Radians ⇒ Gradian

- Iterations: $iterate(firstx : expression)$
  Runs the given iteration, resulting the fix point.
  e.g. $iterate(4 : (xn + (9/xn))/2) = iterate(4 : \frac{x_n+\frac{9}{x_n}}{2}) = \sqrt{9} = 3$
  expresses $x_{n+1} = \frac{x_n+\frac{9}{x_n}}{2}$

- Short sum: $sum(var : start < end\ [\$\ step]; expression)$
  Sums the expression several times, iterating *var* from *start* to *end*.
  e.g. $sum(i : 1 < 4; i) = \sum_{i=1}^{4} i = 1 + 2 + 3 + 4 = 10$

- Short product: $product(var : start < end\ [\$\ step]; expression)$
  Multiplies the expression several times, iterating *var* from *start* to *end*.
  e.g. $product(i : 1 < 5; i) = \prod_{i=1}^{5} i = 5! = 1 \times 2 \times 3 \times 4 \times 5 = 120$

- Zero: $zero(var : expr)$
  Finds the zero of a function.
  e.g. $zero(a : 5 * a - 55) = 11$
  because $5 \times 11 - 55 = 0$

- Solve: $solve(var : expr1 = expr2)$
  Solves the equation.
  e.g. $solve(a : a\hat{}2 = 49) = 7$
  because $7^2 = 49$

1.2 Constants

Fu Bar knows these constants:

- tau: τ, a full radian turn, about 6.28
- pi: π, $\frac{\tau}{2}$, a half radian turn, about 3.14
- phi: Φ, the golden ratio, about 1.62
- full: A whole, 1
- half: $\frac{1}{2} = 0.5$
- quarter: $\frac{1}{4} = 0.25$

1.3 Units

- deg: Degrees, full turn = 360
- grad: Gradians, full turn = 400
- rad: Radians, full turn = τ
- turn, tau: τ-Radians, full turn = 1
- pi: π-Radians, full turn = 2

1.4 Comparison

You can simply compare two expressions using an equation operator:
$expression_1 = expression_2$

Fu Bar will tell you the result, and whether the terms are equal or not.
If not, it will tell you, which term is the greater one, and output the difference and the factor.

1.5 Custom variables

You can simply save results into your own variables:
$[\,name\,]\ expression$

Fu Bar will compute the term and save the result to a variable of your choice.
To mark it as a constant, insert an exclamation mark before the name:
$[\,!name\,]\ expression$

Note: Fu Bar won't overwrite constants!

1.6 Custom functions

Of course, you can define custom functions, too:
$[\,name(\,var\,)\,]\ expression$

To mark it as read-only, insert an exclamation mark before the name:
$[\,!name(\,var\,)\,]\ expression$

To ensure, that the argument is not zero, add 'nonzero' before the var name:
$[\,name(\,\text{nonzero}\,var\,)\,]\ expression$

To assign a separate value to $name(0)$, enter:
$[\,name(0)\,]\ expression$

For example:

$[\,f(x)\,]\ 25x$	$\Rightarrow 0$
$f(4)$	$\Rightarrow 100$
$[\,f(\text{nonzero}\,x)\,]\ 1/x$	$\Rightarrow 1$
$f(4)$	$\Rightarrow 0.25$
$f(0)$	$\Rightarrow$ Function not defined for $x = 0$
$[\,f(0)\,]\ 0$	$\Rightarrow 0$
$f(4)$	$\Rightarrow 0.25$
$f(0)$	$\Rightarrow 0$

1.7 Explanations

Fu Bar can tell you the steps, how to calculate a term.
: $explain\ 32 * (1 + 5)$ will result:

$1 + 5 = 6$
$32 * 6 = 192$

Come on, try it!