

# DTI Guide: C3 Expressions

C3 includes an expression evaluation system to make it easy to build simple functions. Essentially, they are one-line Java expressions.

C3 Expressions are used all over the C3 AI Suite.

- Filter fields
- Projection expressions
- Data Transforms
- Dataset Processing
- Timeseries Metric expressions
- etc...

The C3 AI Suite supports a java-like expression syntax allowing the user to define complex functions quickly and easily throughout the Suite. This pseudo-language supports basic arithmetic and boolean operators as well a large set of built-in functions known as the ExpressionEngineFunctions.

Here are some useful techniques and syntax which is available in C3 Expressions, but which may not be easy to find in current documentation

## Supported Syntax

- **Comparisons**
  - Expressions like  $a > b$ ,  $c \geq d$  which return boolean values
- **Ternary Operators** which return a value based on the result of a boolean expression
  - `<conditional_expression> ? <value_if_true> : <value_if_false>`
- **Java basic math operators**
  - Addition (+)
  - Subtraction (-)
  - Multiplication (\*)
  - Division (/)
  - Modulus (%)
  - etc...
- **Java Standard Libraries and Functions**
  - Ex: Math - Math.abs, Math.cos, etc...
  - Type casting - ex. `dateTime('2020-01-01')`
- **ExpressionEngineFunctions (C3 defined functions)**
  - `rolling(aggFunc, input_series, ...)` - Computes a rolling aggregation of the input timeseries
  - `identity(value)` - Produces a new timeseries consisting of repeating entries of 'value'.
  - `eval(aggFunc, interval, input_series, ...)` - Forces evaluation of the input timeseries at the set interval, and aggregation with aggFunc.
  - Most ExpressionEngineFunctions are designed to work with timeseries data

## Special keywords

`this`

Sometimes, it may be useful for a timeseries to refer to itself, or to get a reference to the 'current' timeseries. This is done with the `this` name. For example, we can specify the `transform` field of a `TsDecl` metric to do some transformation of the data before it heads to normalization. We can use the `fillMissing` function to fill gaps in the data with a specified value. We'd specify this with `fillMissing(this, <value_to_fill>)`.

## Especially Useful Expressions

### Ternary Operators

Ternary Operators are widely useful throughout the C3 AI Suite. They allow small conditional expressions which can affect the return value of your expression.

### Timeseries expressions

- `rolling`
  - computes a rolling aggregation over a timeseries. It takes an aggregation function, a timeseries (which will be aggregated), and possibly another timeseries to signal when to restart the aggregation. `rolling` is like an expanding window function which may be dynamically reset.
- `identity`
  - takes a value, and simply repeats this value when building the timeseries. it's useful occasionally if you need a timeseries consisting entirely of one value.
- `eval`
  - generates a timeseries using a specific start/end date. This is useful for generating timeseries that rely on window functions which may rely on values before the start date of a requested timeseries. Essentially, `eval` builds an entire timeseries which is passed to the next function or on to the next step in the normalization process.
- `rollingdiff`

- returns a time series in which every value is computed by taking the difference between current and previous point.
- fillMissing
  - Will impute missing values with some default value you specify. This is useful if you want to indicate missing values in some special way.

## Official Documentation

- General topic page: <https://developer.c3.ai/docs/7.19.0/topic/metrics-expression-engine-functions-home>
- A list of ExpressionEngineFunctions is available
  - Online: <https://developer.c3.ai/docs/7.19.0/type/ExpressionEngineFunction>
  - Through the Static Console: `c3ShowType(ExpressionEngineFunction)`