



Racket Basics & Syntax

Core Syntax

Expressions	Racket code consists of expressions. Expressions can be literals, identifiers, or procedure applications.
Procedure Application	<code>(procedure-name arg1 arg2 ...)</code> Applies a procedure to arguments. Parentheses are <i>required</i> .
Defining Variables	<code>(define variable-name expression)</code> Binds a value to a variable.
Comments	<code>;</code> - Single-line comment. <code># ... #</code> - Multi-line comment.
Boolean Values	<code>#t</code> (true) and <code>#f</code> (false). Everything except <code>#f</code> is considered true in conditional contexts.
Number Types	Racket supports integers, rational numbers, real numbers, and complex numbers.

Basic Data Types

Numbers: Integers, decimals, fractions.
Booleans: <code>#t</code> (true), <code>#f</code> (false).
Strings: Enclosed in double quotes, e.g., <code>"hello"</code> .
Symbols: Quoted identifiers, e.g., <code>'symbol</code> .
Lists: Ordered collections, e.g., <code>(1 2 3)</code> .
Vectors: Fixed-size arrays, e.g., <code> #(1 2 3)</code> .

Common Procedures

<code>(+ x y ...)</code>	Addition.
<code>(- x y ...)</code>	Subtraction.
<code>(* x y ...)</code>	Multiplication.
<code>(/ x y ...)</code>	Division.
<code>(= x y ...)</code>	Numerical equality.
<code>(< x y ...)</code>	Less than.

Control Flow

Conditionals

<code>(if condition then-expression else-expression)</code> Evaluates <code>condition</code> . If true (not <code>#f</code>), evaluates <code>then-expression</code> ; otherwise, evaluates <code>else-expression</code> .
<code>(cond [condition expression] ... [else expression])</code> A series of conditional clauses. Evaluates the <code>condition</code> of each clause until one is true, then evaluates the corresponding <code>expression</code> . The <code>else</code> clause is optional and provides a default.

Boolean Logic

<code>(and expr ...)</code> Returns <code>#t</code> if all expressions are true (not <code>#f</code>), otherwise <code>#f</code> . Short-circuits.
<code>(or expr ...)</code> Returns <code>#t</code> if at least one expression is true (not <code>#f</code>), otherwise <code>#f</code> . Short-circuits.
<code>(not expr)</code> Returns <code>#t</code> if <code>expr</code> is <code>#f</code> , otherwise <code>#f</code> .

Iteration

<code>(for ([item sequence]) body ...)</code> Iterates over a <code>sequence</code> (e.g., a list or vector), binding each element to <code>item</code> and evaluating <code>body</code> in each iteration.
<code>(for/list ([item sequence]) body ...)</code> Similar to <code>for</code> , but collects the results of evaluating <code>body</code> into a list.
<code>(let loop ([var1 init1] [var2 init2] ...) body)</code> Defines a local recursive loop.

Data Structures

Lists

<code>(list arg ...)</code> Creates a new list containing the given arguments.
<code>(cons first rest)</code> Constructs a new list by adding <code>first</code> to the beginning of <code>rest</code> (which must be a list).
<code>(car list)</code> Returns the first element of <code>list</code> .
<code>(cdr list)</code> Returns the rest of <code>list</code> (excluding the first element).
<code>(null? list)</code> Returns <code>#t</code> if <code>list</code> is empty, otherwise <code>#f</code> .
<code>(length list)</code> Returns the number of elements in <code>list</code> .

Vectors

<code>(vector arg ...)</code> Creates a new vector containing the given arguments.
<code>(vector-ref vector index)</code> Returns the element at <code>index</code> in <code>vector</code> .
<code>(vector-set! vector index value)</code> Sets the element at <code>index</code> in <code>vector</code> to <code>value</code> . Vectors are mutable.
<code>(vector-length vector)</code> Returns the number of elements in <code>vector</code> .
<code>(vector? obj)</code> Returns <code>#t</code> if <code>obj</code> is a vector, otherwise <code>#f</code> .

Hash Tables

<code>(make-hash)</code> Creates a new empty hash table.
<code>(hash-set! hash key value)</code> Associates <code>key</code> with <code>value</code> in <code>hash</code> .
<code>(hash-ref hash key)</code> Returns the value associated with <code>key</code> in <code>hash</code> . Raises an error if the key is not found.
<code>(hash-ref hash key default-value)</code> Returns the value associated with <code>key</code> in <code>hash</code> . Returns <code>default-value</code> if the key is not found.
<code>(hash-remove! hash key)</code> Removes the association for <code>key</code> in <code>hash</code> .

Modules

Module Definition

`#lang racket`

Specifies the language (in this case, Racket) for the module. This should be the first line of your file.

`(module name language ... body ...)`

Defines a module named `name` using the specified `language`. The `body` contains definitions, expressions, and imports.

Exports

`(provide identifier ...)`

Specifies which identifiers (variables, procedures, etc.) are exported from the module and made available to other modules.

`(provide (all-defined-out))`

Exports all identifiers defined within the module.

Imports

`(require module-path ...)`

Imports identifiers from the specified `module-path`. `module-path` can be a file path, a library name, or a module name.

`(require (prefix id module-path))`

Imports identifiers from `module-path`, prefixing each with `id`.

`(require (only-in module-path id ...))`

Imports only the specified identifiers from `module-path`.