



OVERVIEW & INSTALL

TypeScript modern, expressive programming language
Check version
`typescript --version`
Install via official installer, package manager, or version manager
Popular package managers: cargo, pip, gem, npm, brew

BASIC SYNTAX

Variables, control flow, expressions
// Variable declaration
`let x = 10;`
// Conditional
`if x > 5 { ... } else { ... }`
// Loop
`for item in collection { ... }`

DATA TYPES

Primitive: integers, floats, booleans, strings
Composite: arrays, maps, tuples, structs
// Typed declaration
`let name: String = "Alice";`
`let numbers: Vec<i32> = vec![1, 2, 3];`
Strong typing prevents common runtime errors

FUNCTIONS

```
fn greet(name: &str) -> String {  
  format!("Hello, {}!", name)  
}  
let result = greet("World");  
First-class functions;  
lambdas/closures supported  
let double = |x| x * 2;
```

OOP / MODULES

Structs, classes, or records with methods
`struct User { name: String, age: u32 }`
`impl User {`
 `fn new(name: &str) -> Self { ... }`
 `fn greet(&self) -> String { ... }`
`}`
Interfaces / traits / protocols for polymorphism

COLLECTIONS

```
// Array / slice  
let arr = [1, 2, 3];  
// Dynamic list  
let mut list = Vec::new();  
list.push(42);  
// Map / dictionary  
let mut map = HashMap::new();  
map.insert("key", "value");
```

ERROR HANDLING

Result/Option types or exceptions
`fn read_file(path: &str) ->`
`Result<String, Error> {`
 `Ok(std::fs::read_to_string(path)?)`
`}`
`match result {`
 `Ok(data) => process(data),`
 `Err(e) => eprintln!("Error: {}", e),`
`}`

CONCURRENCY / ASYNC

Threads, async/await, or actor model
`async fn fetch_data(url: &str) ->`
`Result<String> {`
 `let resp = client.get(url).await?;`
 `resp.text().await`
`}`
`tokio::main / async_std / smol`
Green threads or OS threads
depending on runtime

TESTING

Built-in or framework test support
#[test]
`fn test_greet() {`
 `assert_eq!(greet("Alice"), "Hello, Alice!");`
`}`
`cargo test / run test suite`
Unit tests co-located with source code

ECOSYSTEM & PACKAGES

Package registry and dependency management
Add dependency
`cargo add serde`
In Cargo.toml:
[dependencies]
`serde = { version = "1.0", features =`
 `["derive"] }`
Curated ecosystem with popular libraries for HTTP, JSON, DB

CLI & BUILD TOOLS

<code>cargo build</code>	compile project
<code>cargo run</code>	build and run
<code>cargo test</code>	run tests
<code>cargo fmt</code>	format code
<code>cargo clippy</code>	linting
<code>cargo doc</code>	generate documentation

Integrated toolchain for build, test, and docs

COMMON GOTCHAS

Follow language-specific naming conventions
Understand ownership/borrowing/GC model for this language
Use idiomatic patterns don't port code from other languages
Check community guidelines for error handling approach
Profile before optimizing
correctness first