Elm Friendly functional frontend

START HERE

`elm init`
New project

`elm install <author/package>`
Add a package

`elm reactor`
Dev server on :8000

`elm repl`
Try expressions

`elm make src/Main.elm`
Compile to index.html

`elm make src/Main.elm --optimize --output=elm.js`
Production build

`elm make src/Main.elm --output=elm.js`
Compile to JS

`elm-test`
Run tests

Model all state → `view` → **View** Html Msg → `user event` → **Msg** what happened → `update` → **Update** returns new Model

The Elm Architecture

CONCEPTS

Read compiler errors top to bottom: they usually name the fix.

Maybe and Result make failure explicit, so normal Elm code has no runtime exceptions.

Install the tools with npm: npm install -g elm elm-format elm-test.

PROJECT

`elm init`
Create elm.json and src/

`elm install <author/package>`
Add a dependency
Example: elm install elm/http. Applications pin exact versions in elm.json.

`elm repl`
Start an interactive session

`elm <command> --help`
Help for a command

`elm --version`
Print compiler version

BUILD

`elm make src/Main.elm`
Compile to index.html

`elm make src/Main.elm --output=elm.js`
Compile to a JS file

`elm make src/Main.elm --optimize`
Optimized build, no Debug
Fails if Debug.log or Debug.toString remain; then minify with uglify-js or terser.

`elm make src/Main.elm --debug`
Add the time-travel debugger

`elm make src/Main.elm --output=/dev/null`
Type-check only, no output

`elm make src/A.elm src/B.elm --output=elm.js`
Several Main modules, one file

`elm make src/Main.elm --report=json`
Machine-readable errors

`elm make --docs=docs.json`
Build package docs JSON

`elm reactor`
Serve the project at :8000

`elm reactor --port=<n>`
Serve on another port

PACKAGES

`elm publish`
Publish a package version
Needs a package elm.json, a git tag matching the version and a public repo.

`elm bump`
Compute the next version

`elm diff`
API changes since last publish

`elm diff <author/package> <v1> <v2>`
API changes between versions

`elm install elm/json`
JSON encode and decode

`elm install elm/http`
HTTP requests

`elm install elm/browser`
Browser.element and Browser.application

TOOLING

`elm-format src/ --yes`
Format all files in place

`elm-format src/ --validate`
Fail if not formatted (CI)

`elm-test init`
Create tests/ and test deps

`elm-test`
Run all tests in tests/

`elm-test <file>`
Run one test file

`elm-test --watch`
Re-run on change

`elm-review`
Lint the project with elm-review
Separate npm tool; needs a review/ config, create it with elm-review init.

SYNTAX

`module Main exposing (main)`
Module header

`import Html exposing (Html, div, text)`
Import names

`import Html.Attributes as A`
Import with alias

`name : Int → String`
Type annotation

`type alias User = { name : String }`
Name a record type

`type Msg = Inc | Dec`
Custom type

`type Maybe a = Just a | Nothing`
Parameterised type

SYNTAX (cont.)

`case x of ... → ...`
Pattern match

`if a then b else c`
Conditional, always an expression

`let y = 1 in y + 1`
Local bindings

`\x → x + 1`
Anonymous function

`{ model | count = 1 }`
Update record fields

`model.count / .count`
Field access / accessor function

`x |> f |> g`
Pipe left to right

`f << g / f >> g`
Compose functions

CORE LIBRARY

`List.map f xs`
Transform each item

`List.filter f xs`
Keep matching items

`List.foldl f init xs`
Reduce a list

`String.fromInt n / String.toInt s`
Int to string / parse (Maybe)

`Maybe.withDefault 0 m`
Unwrap Maybe with fallback

`Maybe.map f m`
Apply inside Maybe

`Result.map f r`
Apply inside Result

`Dict.fromList pairs`
Build a Dict

`Dict.get key d`
Lookup, returns Maybe

`Debug.log "label" value`
Print and return value

PROGRAMS

`Browser.sandbox`
Simple app: init, view, update

`Browser.element`
App with Cmd, Sub and flags

`Browser.application`
Full app with URL routing

`Cmd.none / Sub.none`
No effect / no subscription

`Http.get { url = u, expect = e }`
GET request as a Cmd

`Decode.field "name" Decode.string`
JSON decoder for a field

PROGRAMS (cont.)

`Html.Events.onClick Msg`
Send a Msg on click

`Html.Events.onInput Msg`
Send a Msg on typing

Program types

Function	Effects	Use for
`sandbox`	none	Learning, toys
`element`	Cmd, Sub	Widget in a page
`document`	Cmd, Sub	Own title and body
`application`	Cmd, Sub, URL	Single-page app

RECIPES

Minimal counter

```
module Main exposing (main)
import Browser
import Html exposing (button, div, text)
import Html.Events exposing (onClick)

main = Browser.sandbox { init = 0, update = update, view = view }

type Msg = Inc | Dec

update msg n =
    case msg of
        Inc → n + 1
        Dec → n - 1

view n =
    div []
        [ button [ onClick Dec ] [ text "-" ]
        , text (String.fromInt n)
        , button [ onClick Inc ] [ text "+" ]
        ]
```

Embed compiled JS in a page

```
# elm make src/Main.elm --output=elm.js
<div id="app"></div>
<script src="elm.js"></script>
<script>
  Elm.Main.init({ node: document.getElementById('app') })
</script>
```

Decode a JSON record

```
import Json.Decode as D

type alias User = { name : String, age : Int }

userDecoder : D.Decoder User
userDecoder =
    D.map2 User
        (D.field "name" D.string)
        (D.field "age" D.int)
```

Release build for production

```
elm make src/Main.elm --optimize --output=elm.js
npx terser elm.js --compress --mangle -o elm.min.js
```