JavaScript learning path

Great 👍 Let's now dive **deep into** `let` — the modern replacement for `var`.
We'll follow the same style: **history → rules → quirks → interview traps → internals**.

🔎 `let` in JavaScript (Deep Dive)

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1. Background

- Introduced in **ES6 (2015)** to fix the problems of `var`.
- Preferred for **mutable variables** (values that change).
- Provides **block scope** and **TDZ (Temporal Dead Zone)** safety.

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2. Core Properties of `let`

✅ a) Block-scoped

```
js

if (true) {
  let x = 10;
}
console.log(x); // ❌ ReferenceError
```

- Unlike `var`, `let` is scoped to `{}` blocks (if, loops, etc.).

✅ b) No Redeclaration (in the same scope)

```
js

let a = 5;
let a = 10; // ❌ SyntaxError
```

- Prevents accidental overwriting like `var`.

✅ c) Reassignment Allowed

```
js

let score = 50;
score = 100; // ✅ allowed
console.log(score); // 100
```

✅ d) Not attached to `window` (global object)

```
js

let name = "Anoop";
console.log(window.name); // ❌ undefined
```

- Safer than `var`, avoids polluting global object.

✅ e) Hoisted but in Temporal Dead Zone (TDZ)

```
js

console.log(x); // ❌ ReferenceError
let x = 5;
```

- `let` is **hoisted**, but not accessible until **after its declaration line**.
- The time between start of scope and declaration is called **TDZ**.

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3. ⚡ Common Pitfalls (Interview Traps)

❌ a) TDZ confusion

```
js

{
  console.log(a); // ❌ ReferenceError (TDZ)
  let a = 20;
}
```

❌ b) Loops with closures (fixed!)

```js
for (let i = 0; i < 3; i++) {
  setTimeout(() => console.log(i), 1000);
}
// ✅ Output: 0, 1, 2
```

- Unlike `var`, each `i` is **block-scoped** per iteration.

❌ c) Block scope shadowing

```js
let x = 1;
{
  let x = 2;
  console.log(x); // 2
}
console.log(x); // 1
```

- Inner `let` shadows outer `let`.

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4. 🧠 Interview Brain-Benders (with Solutions)

Q1:

```js
let a = 1;
function test() {
  console.log(a); // ?
  let a = 2;
}
test();
```

Answer: ❌ ReferenceError

- `a` inside function is in **TDZ** until declared.

Q2:

```js
let x = 10;
if (true) {
  let x = 20;
  console.log(x); // ?
}
console.log(x); // ?
```

Answer:

- Inside block → `20`
- Outside block → `10`

Q3:

```js
for (let i = 0; i < 3; i++) {
  setTimeout(() => console.log(i), 1000);
}
```

Answer: `0, 1, 2`

- Because each loop iteration creates a **new block scope** for `i`.

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5. ⚙️ Hidden Internals

- During **compilation phase**, `let` is hoisted into **Lexical Environment Record**.
- But remains **uninitialized** until its declaration.
- Access before initialization → **TDZ error**.
- This prevents bugs that `var` caused.

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6. 🔧 Real-World Best Practices

- ✅ Use `let` when the value **needs to change**.
- ❌ Don't declare variables before using them (avoids TDZ issues).
- ✅ Use `const` by default, switch to `let` only when reassignment is needed.

- ❌ Never mix `var` and `let` in the same scope.

📌 Summary:

- `var` = function-scoped, hoisted, old, buggy.
- `let` = block-scoped, TDZ safe, good for mutable values.

Would you like me to now move on to `const` **deep dive**,
or first do a **side-by-side comparison of** `var` **vs** `let` **with tricky examples** before continuing?