JavaScript learning path

Alright 🚀 let’s now move to the next primitive:

🟢 `null` in JavaScript (Deep Dive)

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1. 🔹 What is `null`?

- A **primitive value** that explicitly represents *“no value”* or *“empty value”*.
- Unlike `undefined` (which the engine assigns when no value is given), `null` is **intentionally set by the developer**.
- Type check:

  ```js
  typeof null; // "object" ❌ (historical bug in JS)
  ```

  > This is one of the most famous JS quirks. It was a bug in the first JS implementation, but fixing it would break too much existing code — so it’s still `"object"`.

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2. 🔹 When to use `null`

- To **clear/reset a variable**:

  ```js
  let user = "Alice";
  user = null; // clear value, no longer pointing to any object
  ```

- To signal **intentional absence**:

  ```js
  function findUser(id) {
   if (id === 0) return null; // means "not found"
  }
  ```

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3. 🔹 Difference: `undefined` vs `null`

Feature	`undefined`	`null`
Meaning	Declared but not assigned, missing value	Explicitly no value
Type	`"undefined"`	`"object"` (quirk)
Set by	JS engine	Developer
Example	`let a;` `console.log(a);` → `undefined`	`let a = null;`
JSON.stringify behavior	Drops the property	Keeps it as `null`

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4. 🔹 Type Coercion with `null`

```js
Number(null);   // 0
String(null);   // "null"
Boolean(null);  // false
```

👉 Note: Unlike `undefined`, which converts to `NaN` when coerced to a number, `null` becomes `0`.

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5. 🔹 Equality Checks

```js
console.log(null == undefined);  // true  (special loose equality rule)
console.log(null === undefined); // false (different types)
console.log(null == 0);          // false
console.log(null < 1);           // true  (coerces to 0 in comparison)
console.log(null == false);      // false (no coercion to Boolean)
```

⚠ This makes `null` **dangerous** in comparisons.

6. 🔹 Real-World Gotchas

1. Clearing Objects

```js
let obj = { name: "Anoop" };
obj = null; // releases reference, eligible for GC
```

2. Accidental coercion

```js
console.log(null + 5); // 5 (because null → 0)
console.log(null * 2); // 0
```

3. Optional Chaining

```js
let user = null;
console.log(user?.name); // undefined (no crash)
```

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7. 🔹 Best Practices

✅ Use `null` when you want to **explicitly empty/clear** a variable.
✅ Avoid loose equality with `null`, always use `===`.
✅ For APIs, use `null` to mean "no result", not `undefined`.

🧩 Quick Exercise (for you)

What will be the outputs?

```js
console.log(null == 0);      // ?
console.log(null < 0);       // ?
console.log(null <= 0);      // ?
console.log(null >= 0);      // ?
console.log(null + true);    // ?
```

👉 Do you want me to solve this step by step right now, or do you want to try it yourself first?

Perfect 💡 let's solve this `null` **exercise step by step**.

Code:

```js
 console.log(null == 0);      // ?
console.log(null < 0);       // ?
console.log(null <= 0);      // ?
console.log(null >= 0);      // ?
console.log(null + true);    // ?
```

🔎 Step 1: `null == 0`

- Loose equality (`==`) has **special rules**:
  - `null` only equals `undefined` (not 0, false, or anything else).
- So:

  ```js
  null == 0 // false
  ```

✅ Output → `false`

🔎 Step 2: `null < 0`

- Comparison operators (`<`, `>`, `<=`, `>=`) **coerce null to a number**.
- `Number(null) → 0`
- So:

  ```js
  ```

```
0 < 0 // false
```

✅ Output → `false`

🔎 Step 3: `null <= 0`

- Again, `null → 0`.
- So:

  ```js
  0 <= 0 // true
  ```

✅ Output → `true`

🔎 Step 4: `null >= 0`

- Same coercion (`null → 0`):

  ```js
  0 >= 0 // true
  ```

✅ Output → `true`

🔎 Step 5: `null + true`

- `null → 0`
- `true → 1` (when used in numeric context).
- So:

  ```js
  0 + 1 // 1
  ```

✅ Output → `1`

✅ Final Results

```arduino
false
false
true
true
1
```

⚡ Hidden Internals Insight

- `==` works differently from `<` or `<=`.
- With `==`, **no numeric coercion** happens between `null` and numbers.
- With `<, <=, >=`, JS **forces numeric coercion**, so `null → 0`.

👉 This explains why:

```js
null == 0   // false
null <= 0   // true
```

looks contradictory at first glance — but it's due to different coercion rules.

📌 Interview Trick:

If asked *"Why is `null == 0` false but `null <= 0` true?"* → Answer:

Because `==` has special rules (`null` only loosely equals `undefined`), while comparison operators convert `null` to a number (`0`).

Do you want me to now move on to the **next primitive: Boolean**, or explore more **edge cases with `null` (like JSON, typeof bug, and optional chaining)** before moving?

Excellent choice 🎯 — `null` has some of the **strangest quirks** in JavaScript. Let's go deeper into **hidden edge cases & interview-style traps** before moving to the next primitive.

🟣 `null` — Edge Cases & Gotchas

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1. 🔥 `typeof null`

```js
console.log(typeof null); // "object"
```

- This is a **historical bug**:

  Early JS stored values in a *tagged 32-bit system*:
  - Objects → tagged with `000`
  - `null` also got the same tag → `"object"`.
- ECMA decided **not to fix it** for backward compatibility.

👉 So `typeof null` **is** `"object"`, even though it's a primitive.

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2. 🔥 Loose equality trap

```js
console.log(null == undefined); // true
console.log(null == 0);        // false
console.log(null == false);    // false
```

- Special `==` rule:

  Only `null == undefined` → true.

  Anything else → false.

⚠ Many beginners expect `null == 0` or `null == false` → true, but nope.

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3. 🔥 Comparison paradox

```js
```

```
console.log(null > 0);  // false
console.log(null == 0); // false
console.log(null >= 0); // true
```

- As we solved earlier:
    - In comparisons, `null → 0`
    - But in equality, **no numeric coercion**.

This makes `null` **inconsistent** between `==` and `<` / `>=`.

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4. 🔥 `null` in JSON

```js
console.log(JSON.stringify({a: null}));       // {"a":null}
console.log(JSON.stringify({a: undefined}));  // {}
```

- `null` is preserved in JSON.
- `undefined` is dropped completely.

👉 Why? Because JSON is a strict data format, and `undefined` doesn't exist in it.

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5. 🔥 Null in arithmetic

```js
console.log(null + 5);  // 5   (null → 0)
console.log(null * 2);  // 0
console.log(null / 0);  // NaN (0/0)
```

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6. 🔥 Optional chaining with `null`

```js
let user = null;
console.log(user?.name); // undefined (safe access, no error)
```

- Without optional chaining:

```js
console.log(user.name); // ❌ TypeError: Cannot read property 'name' of null
```

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7. 🔥 Double null coalescing

```js
let value = null ?? "fallback";
console.log(value); // "fallback"

let value2 = (null || "fallback");
console.log(value2); // "fallback"
```

But difference:

```js
console.log(0 ?? "fallback");  // 0
console.log(0 || "fallback");  // "fallback"
```

👉 `??` only treats `null` and `undefined` as empty, not falsy values like `0` or `""`.

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8. 🔥 `Object.is` vs `===` with `null`

```js
console.log(Object.is(null, null)); // true
console.log(null === null);         // true
```

No quirk here — both work consistently for `null`.

👉 Problematic only for `NaN` and `+0/-0`.

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9. 🔥 `delete` with null

```js
let obj = {a: 1};
obj = null;
```

```
console.log(obj?.a); // undefined
```

- Assigning `null` means the object reference is dropped → eligible for garbage collection.
- But if you wanted to just remove a property, you must use `delete obj.a`, not `obj = null`.

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10. 🔥 Function defaults vs null

```js

function test(x = 42) {
  console.log(x);
}

test(undefined); // 42 (default applies)
test(null);      // null (default skipped!)
```

👉 Rule: default values **only apply when argument is** `undefined`, not `null`.

✅ Summary of Edge Cases

- `typeof null === "object"` (historic bug).
- `null == undefined → true`, but `null == 0 → false`.
- `null >= 0 → true` but `null == 0 → false`.
- `JSON.stringify(null)` keeps it, `JSON.stringify(undefined)` drops it.
- Defaults skip `null`, but apply on `undefined`.
- Use `??` instead of `||` when you want to handle only `null/undefined`.

👉 Now, should we **move to the next primitive: Boolean** 🚦, or do you want me to show some **advanced interview-level puzzles mixing** `null` **and** `undefined` **together** before moving?