

We will learn Javascript!

- Essential for modern interactive web pages
- Not a JS course
 - Intro + basic concepts
- Can be overused, poorly used
 - Use right tool for right purpose

Javascript (JS)

- Programming language
 - NOT Java
 - Originally for browser
 - Slight differences per engine
- Runs in browser
 - On user's computer
 - NOT on server
 - "client"/"Browser" vs "server"

JS Capabilities

- Can run on load
- Can react to "events"
 - User actions
 - Network actions
- Can change page HTML
 - HTML structure
 - Text
 - Commonly: classes
- Can cause navigation
- Can submit without navigation!

JS can be messy

- Multiple vendors
- Rapidly evolving web
- "Browser Wars"

Result:

- Many ways to do things
 - They often "work"
- Fewer ways that are "good"
 - But still multiple ways

My advice: 3 year rule

- Just like CSS
- Do not trust articles older than 3 years
 - Too much bad advice
- Lots of articles assume certain libraries
 - They probably don't help you
- If you don't understand it
 - Don't copy/use it

The Browser console

Dev Tools -> Console

- Where `console.log('Hello');` will say "Hello"
- Where error messages will appear
- Erased whenever web page loads/reloads
- Can run commands

Inline JS

- HTML elements can have inline JS
- Just like inline CSS: Don't do this
 - Small exceptions

Do not put JS inline in HTML elements

```
<button onclick="console.log('do not do this')">  
  DO NOT  
</button>
```

Inline Script Element

- Like CSS
 - Can place inside an element (`<script>`)
- You should not do this
 - Exceptions apply, but not for this course

Do not put your JS inline in a `<script>` element

```
<script>  
  console.log("Do not do this, either");  
</script>
```


Separate JS File (The Right Way)

- Very similar to CSS
- Load via `src` attribute
 - URL is fully qualified
 - Or absolute path
 - Or relative path
- Still a `script` element
 - But not inline
- Requires closing tag

```
<script src="myfile.js"></script>
```

JS File structure

- Works without this "boilerplate"
 - "works"
- You should always have this boilerplate
 - Until tools do it for us (later)

```
"use strict";  
(function() {  
  
    // Your code here!  
  
})();
```

Strict Mode

- Web tries to never "break"
 - Changes can't break older material
 - No one will fix most pages
- Strict Mode enforces newer standards
 - Older content won't trigger Strict Mode
- `"use strict";` as first line sets strict mode
 - Ignored by older engines
- Remember how browser tries to guess?
 - We want strict mode as developers

IIFE - Immediately Invoked Function Expression

- Putting your code in an "IIFE" ("iffy")
 - Prevents accidental creation/overwrite of global values
- Syntax makes sense after functions/scopes
- For now always put your code inside an IIFE
 - "works" without it
- My examples often skip strict/iife
 - Skipped to save space/time
 - You should always have them
 - Until I say otherwise

Your First File

index.html

```
<body>
  ...
  <script src="my-file.js"></script>
</body>
```

my-file.js

```
"use strict";
(function() {
  console.log("Hello World");
})();
```

Where to put `<script>`?

- Many examples show `<script>` in `<head>`
- Causes problems if JS interacts with page content
 - Content doesn't EXIST yet
 - Not yet parsed when parsing is at `<head>`

Two solutions for where to put `<script>`

- Solution One:
 - Put `<script>` as last item in `<body>`
 - Content will exist
 - But can interfere with styling
 - `<script>` is a child of `<body>`
- Solution Two:
 - Put `<script>` in `<head>`
 - Add `defer` attribute
 - Won't execute until content loaded
 - Only works if `src` is used
- You can do either solution for this course

Your first file (take two)

index.html

```
<head>
  ...
  <script defer src="my-file.js"></script>
</head>
```

my-file.js

```
"use strict";
(function() {
  console.log("Hello World");
})();
```


Variables

```
// Doing more  
let message = "Hello";  
console.log(message);
```

- The `//` starts a **comment**
 - Goes until end-of-line
 - Purely for humans
- `message` is a **variable**
 - Holds a **value**
- `"Hello"` is a **string value**
 - Collection of **characters**

Declaration

```
let message = "Hello"; // Declare and assign variable  
console.log(message);
```

- **let** **declares** our variable
 - Tells JS engine the word is a variable
 - Once per variable
 - Not required unless Strict Mode
 - Anarchy and chaos (and typos)
 - Always "use strict";
 - JS has other ways to declare (later)

Assignment

```
let message = "Hello"; // Declare and assign variable
console.log(message);
```

- `=` is **assignment**
- Assignment has the **variable** hold the **value**
- Assignment does not hold variables!

```
let message = "Hello";
let alternate = message;
message = "Hi";

console.log(alternate); // "Hello" or "Hi"?
```

- Reading a variable gets the value, not the variable

let and const

- `let`, `const`, and `var` all declare variables
- `var` is old, don't use it
- `const` NOT like other languages
- `const` means "variable does not get reassigned"
 - NOT the same as "constant"
- More later, for now just follow these rules
 - **Use `const` for most variables**
 - **If you reassign the variable, use `let`**
 - **Do not use `var`**
 - Reason: Passively communication

Values have Types

- A value has a **type**
 - What kind of value is it?
 - What can be done with it?
- Example types:
 - Strings (collection of characters)
 - Boolean (`true` or `false`)
 - Numbers (`5`, `8`, `1.5`)
 - More later

Typing

- Languages handle types differently
- In different ways
- **dynamic** vs **static** typing
- **strong** vs **weak** typing
- Two different axis

Dynamic vs Static Typing

- **Dynamic typing**
 - Values have types
 - Variables do not have types
 - Use type of current value
 - Examples: Python, Javascript
- **Static typing**
 - Variables declared with types they can hold
 - Examples: Java, C

```
let message = "Hello";  
message = 4; // Dynamic typing (javascript)
```

```
String message = "Hello"; // Static typing (Java)
```

Strong vs Weak Typing

- **Strong typing**
 - Must explicitly change the type
 - Otherwise error
 - Examples: Java, Python
- **Weak typing**
 - Type implicitly converted as needed
 - Known as **coercion**
 - Examples: Javascript, C

```
const num = 4; // Javascript
const message = "Hello-" + num; // "Hello-4"
```

```
int num = 4; // Java
String message = "Hello-" + (String) num;
```


Casing

```
let message = "Hello World"; // `let` warns of reassignment
const alternateMessage = message;
message = "Hi";

console.log(alternateMessage); // "Hello World"
```

- `alternateMessage` is multiple words
 - No space
 - No punctuation
 - Later words have first letter capitalized
 - Known as **camelCase**
 - Not **MixedCase** or **snake_case** or **kebab-case**

Semicolons

```
let message = "Hello World";  
const alternateMessage = message;  
message = "Hi";  
  
console.log(alternateMessage); // "Hello World"
```

- Each instruction (**statement**) ends in `;`
- Everything in JS is **statement** or **block**
 - Statements end in `;`
 - Blocks end in `{}`
 - Usually statements/blocks inside `{}`
- **statements** can be/have **expressions**
 - Expressions evaluate to **values**

JS is very flexible language

- A lot of syntax is *optional*
 - Or has many ways to show it
- Example: Code often works without semicolons
 - Some communities in JS embrace this!
 - **This course requires you use semicolons**
 - Learn it, then you can choose
 - You know a statement ends at end of line
 - Programming is Communication

Some choices are **conventions**

- Example: JS can handle any casing on variables
- **This course requires you use camelCase**
 - Casing is for humans
 - Everyone will use this convention
 - **There are exception**
 - Classes/Components use **MixedCase**
 - constants use **CONSTANT_CASE**

Whitespacing in code for humans

- These two run the same for computer
- Second is better for humans
- Programming is Communication

```
let message="Hello World";  
const alternateMessage=message;message="Hi";  
console.log(alternateMessage); // "Hello World"
```

Better:

```
let message = "Hello World";  
const alternateMessage = message;  
message = "Hi";  
  
console.log( alternateMessage ); // "Hello World"
```

Names really matter!

- These two run the same for computer
- Second is better for humans
- Programming is Communication

```
let m = "Hello World";  
const aM = m;  
m = "Hi";  
  
console.log(aM); // "Hello World"
```

Better:

```
let message = "Hello World";  
const alternateMessage = message;  
message = "Hi";  
  
console.log( alternateMessage ); // "Hello World"
```

Functions

Functions are a collection of instructions (**statements**)

- Can be **called**
 - Run the instructions
- Can be **passed** values
- Can **return** values
 - Treat as if call is replaced with returned value
- Can be reused
 - Called multiple times
 - Possibly passed different values

Console.log is a function!

- `console.log` is a function
 - The `()` **calls the function**
 - Any values passed are between `()`
 - Comma separated

```
const message = "Hello";  
const target = "World";  
console.log(message, target);
```

- All functions take **arguments** between `()`
 - Including no arguments (`console.log();`)

Declaring a function

```
function someFunction() {  
  const message = "Hello World";  
  console.log(message);  
}
```

- `someFunction`
 - JS variables (incl functions) are **camelCase**
- Function declaration is a **block**
 - Does not end in `;` (not a **statement**)
- Doesn't output anything!
 - We didn't call it

Calling our function

```
function someFunction() {  
  const message = "Hello World";  
  console.log(message);  
}  
  
someFunction();  
someFunction();
```

- Functions called with `()`
- Can be called multiple times
- Function block runs each time

Passing values to a function

```
function greet( name ) {  
  const message = "Hello, " + name;  
  console.log( message );  
}  
  
greet( "Jorts" ); // "Hello, Jorts"
```

- Passed values assigned to variables
 - from function declaration
 - No `let` here

Scopes

- A variable lives in a **scope**
 - Where it can be seen and used
- JS uses **lexical scoping**
 - Nested scopes
 - If variable isn't in current scope
 - Checks enclosing scope(s)
- Same variable name can exist
 - Different scopes = different variables!

Scopes Example

```
const message = "Hello";
const name = "Jorts";
const separator = ", ";

function demo( message ) {
  const name = "Jean";
  console.log( message + separator + name );
}

demo( "Hi" ); // "Hi, Jean"
console.log( message + separator + name ); // "Hello, Jorts"
```

- Each block has a new **scope**
 - Inside existing scope
- Variables for current scope are used
 - Unless not declared in that scope
- Changes only impact variable used

Functions can return a value

```
function makeGreeting( name ) {  
  const message = "Hello, " + name;  
  return message;  
}  
  
// "Hello, Jorts"  
console.log( makeGreeting( "Jorts" ) );
```

- **parameters** to function in `()` in declaration
 - comma separated if multiple
- **return** statement gives value to return
- function call replaced with value returned
- **whitespace** is for humans
- function **names** important to understand

More on returning values

- Function block stops executing on return
- Can only return a single value

```
function makeGreeting( name ) {  
  const message = "Hello, " + name;  
  return message;  
  console.log("This does not print");  
}  
  
// "Hello, Jorts"  
console.log( makeGreeting( "Jorts" ) );
```

Callbacks

- Functions in JS are "first-class citizens"
 - A value like everything else
 - Not true in all languages
- Can assign a function to a variable
- Can pass a function to another function
- Don't use `()` to get value
 - `someFunction` is that function value
 - `someFunction()` CALLS that function
 - evaluates to return of that function call

Callback Example

```
function makeGreat( name ) {  
    return name + " The Great";  
}  
  
function makeCat( name ) {  
    return name + " The Cat";  
}  
  
function greet( name, makeTitle ) {  
    console.log( makeTitle(name) );  
}  
  
greet( "Jorts", makeGreat ); // Jorts The Great  
greet( "Jorts", makeCat ); // Jorts The Cat
```

JS Uses Callbacks a lot...why?

- Callbacks let us hand off control
- Example: "When button clicked, call this function"
- We will do this A LOT

DOM - Document Object Model

- JS Data Structure (tree) of the page elements
- Lets us interact with rendered elements
 - Read
 - Edit
 - Delete
 - Respond to **events**
 - Such as "click"
 - Or typing in a form field
 - Or a form "submit"

Finding a DOM Node

- DOM has all elements of page (**document**)
- How to find one of them?
- We *could* use older methods:
 - `document.getElementById()`
 - `document.getElementsByClassName()`
 - `document.getElementsByTagName()`
- But we already know a way to select an element
 - CSS Selectors!

document.querySelector()

- Pass it a selector (as a string)
- It returns a value that is a **DOM Node**
- Only returns first matching element
 - Cover multiple shortly

What to do with an element node

Once you have an element node

- What do you do with it?
- Can read it
 - content text/HTML
 - attribute values
- Can change it
 - content text/HTML
 - attribute values
 - classes
- Can delete it

Example

in HTML:

```
<button type="button">DO NOT TOUCH</button>
```

In JS:

```
const buttonEl = document.querySelector("button");

buttonEl.addEventListener("click", function() {
  console.log("Ow! I asked you not to touch!");
});
```

A lot going on there

```
const buttonEl = document.querySelector("button");
```

- Save the DOM Node to a variable

```
buttonEl.addEventListener(...);
```

- Calling some function that's part of the DOM Node
 - More later
- From name: "adding" an "event listener"

```
buttonEl.addEventListener("click", function() {...} );
```

- The name of the **event** we listen for is "click"
- We pass a callback function

Events

- **Events** happen to DOM Nodes
 - like "click", "input", "submit", etc
- We can add **event listeners**
 - Pass **callback functions**
 - Called when event happens
 - Each time event happens

CSS Classes

- Modifying CSS classes is *very* common
- Each DOM node has a `classList`
 - Has some helpful functions on it

Example HTML:

```
<div class="demo active">Some Content</div>
```

Example JS:

```
const demoEl = document.querySelector(".demo");  
  
// demoEl.classList.add("active");  
// demoEl.classList.remove("active");  
demoEl.classList.toggle("active");
```

Changing class on event

Example HTML:

```
<button type="button" class="toggle-active">Toggle</button>  
<div class="demo active">Some Content</div>
```

Example CSS:

```
.demo.active {  
  background-color: dodgerblue;  
}
```

Example JS:

```
const buttonEl = document.querySelector(".toggle-active");  
const demoEl = document.querySelector(".demo");  
  
buttonEl.addEventListener("click", function() {  
  demoEl.classList.toggle("active");  
});
```

Notice the timing!

- Most of the JS runs on page load
- Callback function runs after event
 - And on each time event happens
- A `console.log()` can tell us when
 - A debugging technique!
 - Remove debugging before submitting

```
const buttonEl = document.querySelector(".toggle-active");
const demoEl = document.querySelector(".demo");

console.log("page loaded");
buttonEl.addEventListener("click", function() {
  console.log("Runs after click");
  demoEl.classList.toggle("active");
});
```

Changing CSS properties

- You CAN change CSS with JS
 - By changing `style` attribute
 - But mostly SHOULD NOT change CSS with JS
 - We don't want to use the `style` attribute
- Instead change CSS classes
 - Have both/all versions of CSS prewritten
 - Like `:hover`/`:focus`
 - CSS exists before it applies

What's with the dots?

- You may have noticed some "dots" in commands:

```
document.querySelector();  
console.log();  
buttonEl.addEventListener();  
demoEl.classList.toggle();
```

To better understand, we need to learn about...

JS Objects

- Objects are a data **type**
 - They are a **value**, like strings and numbers
- Objects are a **collection**
 - Can hold multiple values
 - A value holding values
- Unlike some languages
 - Objects are not all instances of **classes**
 - "classes" different than CSS classes
 - JS Objects are dictionaries or hashmaps

JS Objects are a huge deal

- JS Objects are used so many different ways
- Highly flexible and powerful
- Primary way to collect values
- Can be confusing for those from other languages

JS Object Basics

- Objects hold values by a **key**
 - A string label
 - ANY value type
 - Each key/value is a **property**
- Objects are created by using `{}`
 - **curly braces**
 - Not a block - has semicolon!
 - NOT `new Object()`

```
const cat = {  
  name: "Jorts",  
  age: 3  
};  
console.log(cat);
```

JS Object Syntax Basics

```
const name = "Jorts";  
const cat = {  
  name: name, // Using a variable for value  
  age: 3,      // Trailing comma  
};  
console.log(cat);
```

- Keys before a `:`
 - Keys are strings
 - Do not need to be quoted, UNLESS
 - start with number
 - have spaces or special characters
- Comma (`,`) after value
 - "Trailing" commas allowed

Dot notation

- Properties can be accessed by key

```
console.log( cat.name ); // Jorts  
console.log( cat.age ); // 3
```

- This can be used to modify or add properties

```
cat.age = 4; // changed existing property  
cat.color = "Orange Tabby"; // added and set property  
  
console.log(cat);
```

Methods

- A function is a JS value
- An object property can hold ANY JS value
- A property that is a function is called a **method**

```
const cat = {  
  name: "Jorts",  
  meow: function() {  
    console.log("meow");  
  },  
};  
  
cat.meow();
```

Looking back at our dot usage

- `document.querySelector();`
 - `document` is an object, root of the DOM "tree"
 - `querySelector` is a method
- `console.log();`
 - `console` is an object, `log` is a method
- `buttonEl.addEventListener();`
 - `buttonEl` is an object, a DOM Node
 - `addEventListener` is a method
- `demoEl.classList.toggle();`
 - `classList` - an object property of a DOM Node
 - `toggle` is a method on the classList object

Nested Objects

- Objects are JS values
- Object properties can hold ANY JS value

Objects properties can hold objects

- `demoEl.classList.toggle()`
- `demoEl` is a DOM Node object
- `classList` is a property of `demoEl`
- `classList` is an object
 - `classList` has properties and methods
 - like `add`, `remove`, and `toggle`

Index notation

- Dot notation works great, except
 - When you are accessing using a variable property name
 - When property name requires quoting

For these cases, we use **index notation** with `[]`

Index Notation with Variable

```
const sleepingCats = {  
  Jorts: true, // Properties are normally camelCase  
  Jean: false, // Here it is based on data, so not camelCase  
};  
  
function wakeUp( name ) {  
  // Below would create property "name" :(  
  // sleepingCats.name = false;  
  sleepingCats[name] = false;  
}  
  
wakeUp( "Jorts" );  
console.log( sleepingCats );
```


Index Notation with Special Characters

```
const catColorsWeHave = {  
  "orange tabby": true,  
  "tortoiseshell": true,  
};  
  
// Below would look at .gray then fail  
// catColorsWeHave.gray tabby = true;  
  
// Below just fails  
// catColorsWeHave."gray tabby" = true;  
  
// This works  
catColorsWeHave["gray tabby"] = true;
```

Object Mutation

- Most JS values are **immutable**
 - Can replace value, but not change it
 - `num = 4; num = num + 1;` replaces 4 with 5
 - Change involves **reassignment** (no `const`!)
- Objects can **mutate**
 - Change a value IN the object
 - Object itself is still same container
 - Object is like a box
 - Changing contents is still same box
- Mutating an object does not change object value
- The object value is the container

Mutation Example

```
const name = "Jorts";
const cat = {
  name: name,
  age: 3,
};

function change( name, cat ) {
  name = "Jean"; // Changes variable in local scope
  cat.age = 5;   // Changes stored value IN object
}

change( name, cat );

console.log( name ); // Jorts
console.log( cat.age ); // 5 ?!
```

Value vs Reference

"Does JS pass by value or by reference?"

- Not an accurate question for JS
- Everything is a value
 - Objects value is the container (a reference)
- Key lessons:
 - Changing a passed variable:
 - Changes value of that variable in scope
 - Changing a value IN a passed value:
 - Changes the value in that container
- Confused? Just remember objects are mutable

Object shorthand highlights differences

```
const name = "Jorts";  
const age = 3;  
const plaything = "pipe cleaner";
```

```
const cat = {  
  name: name,  
  toy: plaything,  
  age: age,  
};
```

```
const otherCat = {  
  name,  
  toy: plaything,  
  age,  
};
```

Creating Object with variable property keys

- Needed rarely
- Can create Object property keys from variables

```
const cat1 = "Jorts";
const cat2 = "Jean";

const sleepingCats = {
  [cat1]: true,
  [cat2]: true,
};

console.log(cat); // { "Jorts": true, "Jean": true }
```

Comparison

Comparing two values

- Gives `true` or `false`
- `===` is "is equal to"
- `!==` is "is not equal to"
- `<`, `>`, `<=`, `>=`
 - Normal math comparisons

```
console.log( "Jorts" === "Jean" );  
console.log( 4 < 5 );  
console.log( "Jorts" !== "Jean" );  
console.log( 8 <= 8 );  
console.log( 8 !== 9 );
```

Conditionals (if)

`if` checks if condition is true

```
const num = 8;

console.log(" Thinking... ");

if( num === 8 ) {
  console.log( "Nice!" );
} else {
  console.log( "Not bad" );
}

console.log(" Done ");
```

`if/else` are blocks - no semicolons

Conditional Syntax

The `else` is optional

```
if( num === 8 ) {  
  console.log("Lucky!");  
}
```

You can "chain" many `if/else`

```
if( num === 8 ) {  
  console.log("Lucky!");  
} else if ( num === 9 ) {  
  console.log("My favorite");  
} else if ( num === 1 ) {  
  console.log("The loneliest number");  
} else {  
  console.log("I ran out of space");  
}
```

Technically blocks aren't required - USE ANYWAY

```
// Confusing! Always use {} blocks
if( num === 8)
  console.log("Number is 8");
  console.log("This runs no matter what!");
```

Logical operators

- `&&` is logical "and"
- `||` is logical "or"
- `!` is logical "not"
- `()` group items to ensure order of operations

```
const num = 8;

if( num < 9 && num > 7 ) {
  console.log("Your number is 8"); // or a decimal value
}

if( (num >= 9) || (num <= 7) ) {
  console.log("Your number is NOT 8");
}

if( !true ) {
  console.log("this will never run");
}
```

Identity Comparison

Comparing collections will NOT compare contents

- Instead compares **identity**

```
const one = { name: "Jorts" };
const two = { name: "Jorts" };

if( one === two ) {
  console.log( "This will not print" );
}
if( {} === {} ) {
  console.log( "This also will not print" );
}
```

Comparing contents is complicated

- What if contents include more collections?

More Data Types

We know a bit about:

- String
- Number
- Boolean (`true` and `false`)
- Functions
- Objects

Also have:

- `null` and `undefined`
- Arrays

Nullish values

- A value that means "not a value"
- Can't use 0, because 0 is a value
- Can't use an empty string (`""`), that's a string

JS answers this question TWICE (?!)

- `null` - means "set to not a value"
- `undefined` - means "never had a value"

Together they are **nullish** values

Null

- `null` not used very much
 - Mostly by Java devs learning JS
- Can use to unset a value
 - That's rare

Undefined

- Never explicitly assign a value to undefined
 - That's when you use `null`
- You might *compare* to `undefined`
 - But actually that's rare too
 - Usually check for **falsy** value instead
 - More later
- Variables default to `undefined` value
 - As do object properties

```
let name;  
const cat = {};  
  
console.log(name);  
console.log(cat.name);
```


Deleting an Object property

- Setting an object property to nullish
 - Does NOT remove the property
- To remove an object property use `delete`

```
const cat = {  
  name: "Jorts",  
  coat: "Buttered",  
};  
  
cat.coat = undefined; // Don't do this!  
console.log( cat ); // "coat" property still exists  
  
delete cat.coat;  
console.log( cat ); // No more "coat" property
```

Arrays

An **array** is a special kind of Object

- A function is also a special kind of Object!

Normally "object" means non-array, non-function

- But they are all technically objects in JS

Arrays store and retrieve values in **order**

- Use only when you are going to access by position
- Position is known as **index**, starts at 0

Creating Arrays

- An array is created with **square brackets**
 - `[]`, comma separated values
- Can hold any JS values
- Values do not have to be same type
 - But usually are the same type
- Trailing commas are okay and common

```
const cats = [  
  "Jorts",  
  "Jean",  
  "Nyancat",  
];
```

Accessing Arrays

The individual **elements** (no relation to HTML elements) are accessed using **index notation** and their **position**

```
const cats = [  
  "Jorts",  
  "Jean",  
  "Nyancat",  
];  
  
console.log( cats[0] ); // Jorts  
console.log( cats[2] ); // Nyancat
```

Arrays are Mutable

- Array values can be changed
 - Doesn't change Array value itself
 - Array is a **collection**, just like Object
 - (Array is also an Object)

Array Methods

Arrays have many useful **methods**

- Some examples (see MDN for details):
- `.slice()` - return new array from parts
- `.splice()` - mutate existing array part
- `.indexOf()` - find matching element index
 - Sign you probably want an object
- `.map()` - return new array based on existing
- `.forEach()` - call callback on each element
- `.filter()` - return new array of filtered elements

Using Arrays

- Common mistake to OVERUSE arrays
 - **You probably want a plain object**
- Use Arrays if and only if:
 - You (almost) always access in same order
 - You are creating a stack data structure
 - use `.unshift()` to add to start of array
 - use `.shift()` to pull from start of array
 - You are creating a queue data structure
 - use `.push()` to add to end of array
 - use `.shift()` to pull from start of array

Comparing Arrays

- Arrays are collections
 - Like Objects (*are* Objects)
- Comparing collections compares **identities**
 - Not contents

```
if( ["Jorts"] === ["Jorts"] ) {  
  console.log( "This will not print" );  
}
```

- Comparing contents is complicated
 - Contents might have more collections
 - "shallow" or "deep" comparison
 - How deep?

More about Numbers

JS Numbers handle integers AND floating point (decimal)

```
let num = 8;  
num += 0.5; // same as num = num + 0.5;  
  
console.log( num ); // 8.5
```

Convert a Number to a String with `.toFixed()`

- use `()` around if not a variable
- or `Math.round()`, `Math.floor()`, etc (see MDN)

```
const num = 8.2345;  
  
console.log( num.toFixed(2) ); // 8.23  
console.log( (1234.56).toFixed(1) ); // 1234.6  
console.log( Math.floor(1234.56) ); // 1234
```

When is a number not a number?

```
let num = 8;  
num = num / "cat";  
  
console.log(num);
```

NaN is a special Number value

- Means "Not a Number"
- Doesn't stop program!
 - ...yet

Truthy / Falsy

- Remember **coercion**?
 - Automatic conversion of types
 - Generally bad?
- One type of coercion is good
 - Convert to a Boolean
 - Used in comparison/conditionals
- Conversions to `false` are **falsy** values
 - Conversions to `true` are **truthy** values

Example of Truthy/Falsy benefits

Which do you prefer?

```
if( name !== "" && name !== undefined && name !== null ) {  
  console.log("Looks like they entered a name");  
}
```

Or:

```
if( name ) {  
  console.log("Looks like they entered a name");  
}
```

I hope you like the second one better

What is Truthy/Falsy?

- **truthy** values are anything not **falsey**
- **falsey** values will coerce to `false`:
 - `false` (duh)
 - `0` (the number)
 - `" "` (empty string)
 - `NaN` (Not a Number)
 - `null`
 - `undefined`
- An empty array (`[]`), empty object (`{}`) are **truthy**
- `"0"`, `"NaN"`, `"null"`, and `"undefined"` are **truthy**

When do you Truthy/Falsy

- When doing a comparison for falsy values
 - Just use truthy/falsy
 - No need for comparison operators at all
 - No `==`, No `!=` to falsy values
- Another use for truthy/falsy: "defaulting"

Short-Circuiting

- `&&` and `||` **short circuit**
- `false && thing` - `thing` doesn't matter
 - won't get evaluated
- `true || thing` - `thing` doesn't matter
 - won't get evaluated
- `&&` and `||` don't return true/false
 - They check arguments for truthy/falsy
 - return the "deciding" argument value

Defaulting a variable

Making sure a variable has a good value

```
let name = someFunction();  
if( !name ) {  
  name = "Jorts";  
}
```

Or

```
let name = someFunction();  
name = name || "Jorts"; // name if truthy, else "Jorts"
```

Or

```
let name = someFunction();  
name ||= "Jorts"; // same as: name = name || "Jorts";
```


Nullish Coalescing operator (??)

- Sometimes falsy is too wide
 - 0 is falsy
 - "" is falsy
- Sometimes those are okay values
 - You only want to replace **nullish** values
 - `null` and `undefined`

```
let name = someFunction();  
name = name ?? "Jorts"; // name can be "", etc
```

Or

```
name ??= "Jorts"; // same as: name = name ?? "Jorts";
```

Loose Comparison

Have you wondered why:

- `=` means assignment
- `===` means comparison? (**strict comparison**)
- What is `==`?

`==` is **loose comparison**

- And you mostly shouldn't use it

Using Loose Comparison - Don't

Loose comparison (`==`)

- Allows **coercion**
 - Which can cause unexpected results

```
if( 1 == "1" ) {  
  console.log( "This runs!" );  
}
```

Always use strict comparison

- Unless using truthy/falsy
- Which means no comparison at all!

More about strings

Web dev involves a LOT of strings

- Text inside HTML
- CSS class names
- Text values of form fields
 - All form field values are text, even numbers
- Sometimes HTML as a string

JS has a lot of ways to use strings

Quoting Strings

Strings can be quoted multiple ways:

- Double-quoted (`console.log("Jorts");`)
- Single-quoted (`console.log('Jorts');`)
- Backtick-quoted (`console.log(`Jorts`);`)
 - Creates a **template literal**
 - Template literals have special abilities

What quoting should I use?

- No common convention
- Some teams prefer one style always
- Some teams use single-quoted for HTML
 - Can easily have double quotes INSIDE string
 - `str = '<nav class="menu">';`
- Some teams use double-quoted for English text
 - Can easily have apostrophes INSIDE string
 - `str = "I'm in favor of Jane's idea";`
- Backticks always solves both
 - But this style still rare

Escaping special characters

`\` before quote character inside string works

- `str = 'I\'m in favor of Jane\'s idea';`
- You can see why people don't like to do this

Template Literals

- Template Literals are special strings
- Can span multiple lines

```
console.log(`  
  Hello  
`); // can't be done with " or '
```

- Can **interpolate** values into string
 - Dramatic pause...

Template Literals can Interpolate

- Put expression into `${}` inside template literal
 - Replaces with value of expression
 - `expression` is anything that results in a value
 - variable
 - function call
 - calculation

```
const name = "Jorts";

const hard = "I see " + name + ", the Unbuttered is here";
const easy = `I see ${name}, the Unbuttered is here`;

console.log(hard);
console.log(easy);
```

This has all been JS introduction

- Hardly complete
- SO MUCH THOUGH
- A lot of JS syntax
- The idea of the DOM
- `document.querySelector()` to find a DOM Node
 - Node = a rendered element
- Events
- `.addEventListener()` on a node
 - Passed named event type and callback
 - React to named event type ON that element

JS Requirements For This Course (so far)

- Use semicolons
- Prefer `const`, don't use `var`
- Don't use `style` attribute/property
- Use good variable/function names
- Use helpful whitespace
- Load JS as described
- Don't use `style` attribute/property
- Prefer Objects for collections
 - Use Arrays only if:
 - Using order
 - Accessing by position