JavaScript

Mark Tabor and Abby Chou

Recap

HTML

- Describes **content** and **structure**
- What exists? How is it organized?

```
<!DOCTYPE html>
<html>
    <head>
        <title>A Cool Webpage</title>
    </head>
    <body>
        <p>
            programming is just spicy Googling
        </p>
    </body>
</html>
```

Recap

HTML

- Describes **content** and **structure**
- What exists? How is it organized?

```html
<!DOCTYPE html>
<html>
    <head>
        <title>A Cool Webpage</title>
    </head>
    <body>
        <p>
            programming is just spicy Googling
        </p>
    </body>
</html>
```

CSS

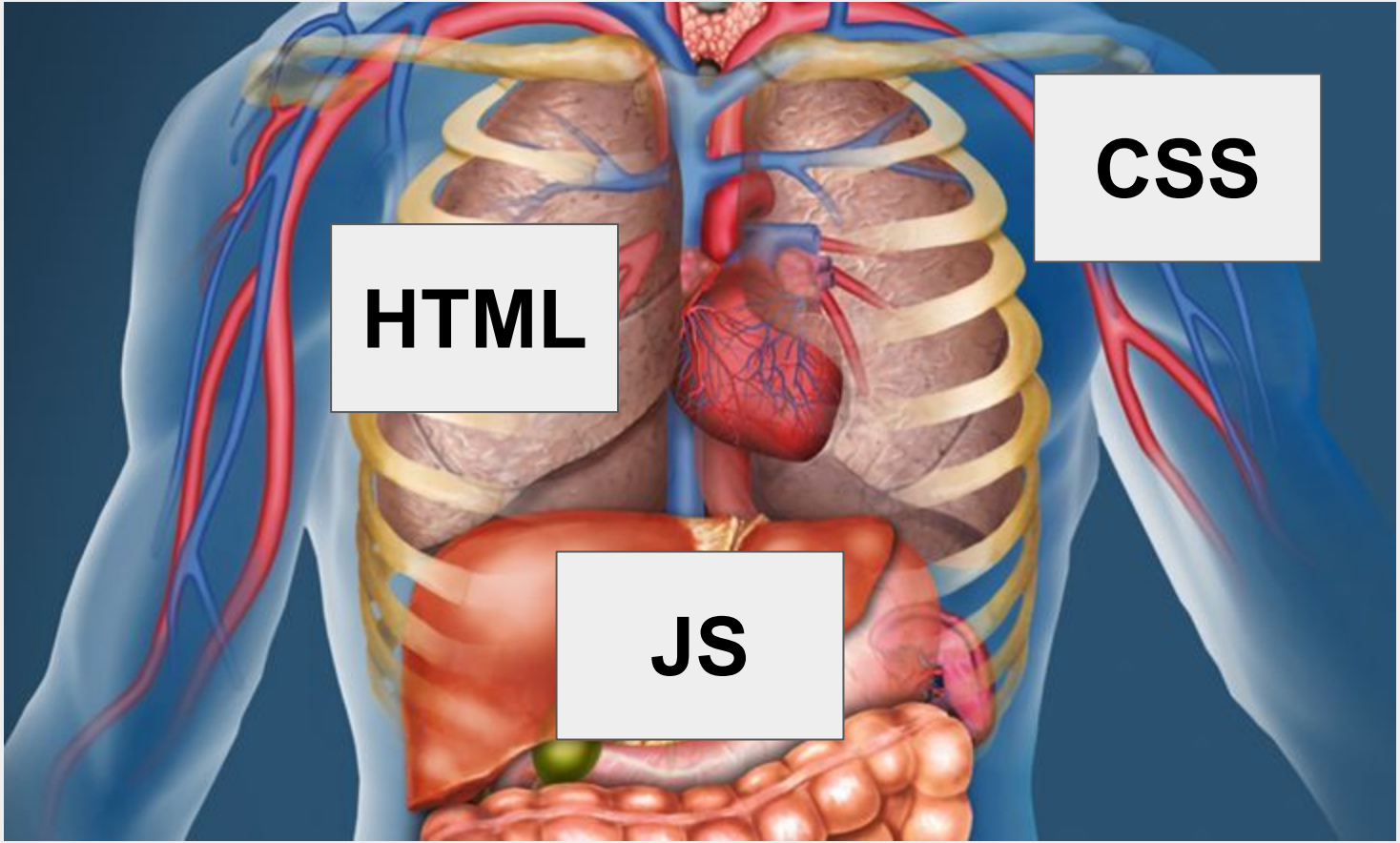
- Describes the **presentation**
- Colors! Fonts! Alignment, margins, borders, shading, and more

```css
body {
  background-color: red;
}

p {
  font-family: Helvetica;
  font-size: 16px;
}
```

JavaScript is...

- ... a programming language that **manipulates** the content of a web page
- ... how we take HTML + CSS and make it **interactive**!
- ... used by a vast majority of websites and web applications

- ... not related to Java 🙃


CSS
HTML
JS

Where does it go?

Where can we run JavaScript code?

1. The browser console
    a. Windows
        i. Chrome: Ctrl + Shift + J
        ii. Firefox: Ctrl + Shift + J
    b. Mac
        i. Chrome: Cmd + Option + J
        ii. Firefox: Cmd + Shift + J
2. Tied to our HTML file (more on that later!)

How to JavaScript

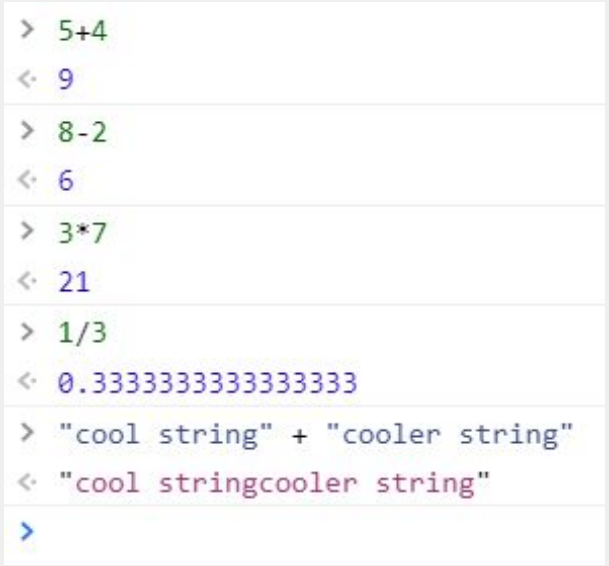
Types

JavaScript has 5 primitive data types:

- Boolean (true, false)
- Number (12, 1.618, -46.7, 0, etc.)
- String (“hello”, “world!”, “12”, “”, etc.)
- Null
- Undefined

Operators

Things (mostly) work how you would expect:



arithmetic operators

Operators

Things (mostly) work how you would expect:

```
> 5+4
< 9
> 8-2
< 6
> 3*7
< 21
> 1/3
< 0.3333333333333333
> "cool string" + "cooler string"
< "cool stringcooler string"
>
```

arithmetic operators

(note the triple equals sign!)

```
> 2 === 2
< true
> 6 !== 7
< true
> 15 < 11
< false
> 8 > 3
< true
> 19 <= 19
< true
>
```

comparison operators

Why we don’t use ==

So, we use === to check equality in JavaScript.

But what does == do?

```
2 === 2;     // true
2 === "2";   // false

2 == 2;      // true
2 == "2";    // also true!
```

It performs *type coercion* (i.e. forces the arguments to be of the same type before comparing them)

tl;dr don’t use ==

Syntax

```
// this function finds the GCD of two numbers
const greatestCommonDivisor = (a, b) => {
  while (b !== 0) {
    const temp = b;
    b = a % b;
    a = temp;
  }
  return a;
}

const x = 50;
const y = 15;
const gcd = greatestCommonDivisor(x, y); // 5
```

Every statement in JavaScript ends with a semicolon;

Whitespace is ignored. (but can improve readability)

Curly braces denote where **blocks** begin and end.

These are **comments**. It doesn't affect how the code runs, but you should use them to keep your codebase readable!

Defining variables

```
let myBoolean = true;
let myNumber = 12;
let myString = "Hello World!";

myBoolean = false;
myNumber = -5.6;
myString = "";
```

Defining variables

JavaScript convention is to name variables using `camelCase`.

```
let myBoolean = true;
let myNumber = 12;
let myString = "Hello World!";

myBoolean = false;
myNumber = -5.6;
myString = "";
```

Defining constants

To define a variable which *cannot* be re-assigned later:

```
const answerToLife = 6.148;

// this WILL NOT work!!!
answerToLife = 42;
```

`let` vs. `const`

Why bother using `const` when `let` exists?

`let` vs. `const`

Why bother using `const` when `let` exists?

Safe code practices! If something should never be changed, don't let it change :)

```
const secondsPerMinute = 60;
// if this needs to be changed, then
// we have bigger issues to address
```

let vs. var

tl;dr please don't use var

```
let userLoggedIn = true;
```

~~`var userLoggedIn = true;`~~

`let` vs. `var`

```
let userLoggedIn = true;
```

tl;dr please don't use `var`

~~`var userLoggedIn = true;`~~

technical details (Google it if you're interested):

- `let` is block-scoped
- `var` is function-scoped
- `let` exists because people kept getting bugs when trying to use `var`

Questions?

`null` vs. `undefined`

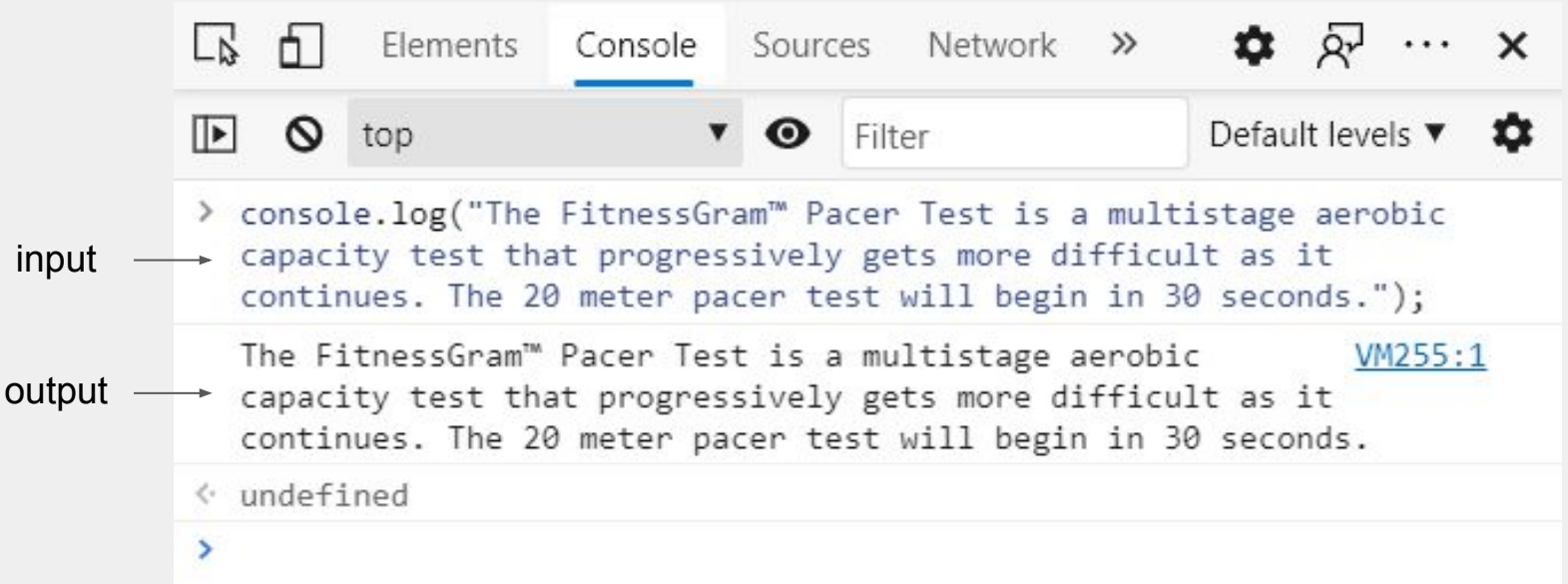
`undefined` means "declared but not yet assigned a value"

`null` means "no value"

```
let firstName;
// currently, firstName is undefined

firstName = "Albert";
// firstName has now been assigned to a value

firstName = null;
// we can explicitly "empty" the variable
```

Output

`console.log()` writes to the JavaScript console:



Output

Handy for quick debugging!

```
let salary = 30000;
salary = salary + 5000;
salary = salary * 2;

console.log(salary);
// should output 70000
```

Output

Can also console log with *template strings* for more descriptive logging

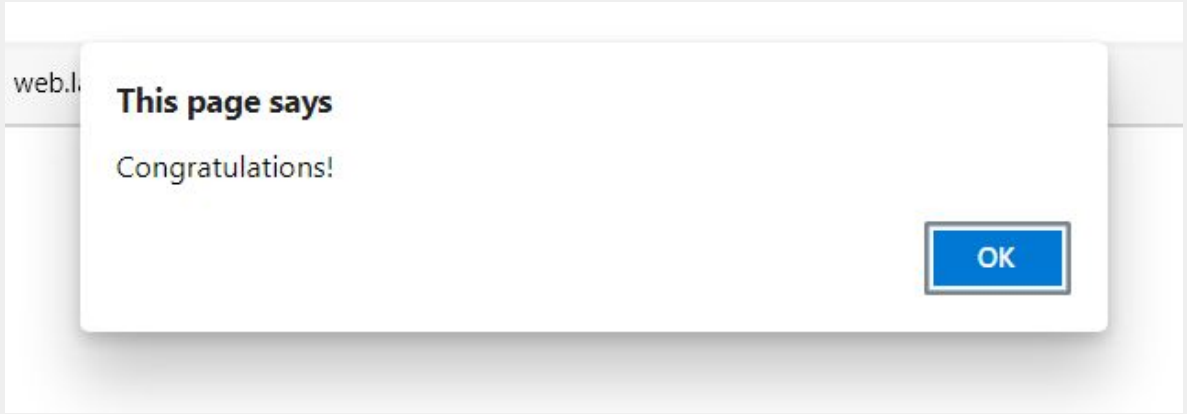
```
const a = 5;
const b = 10;

console.log(`a * b = ${a * b}`);
```

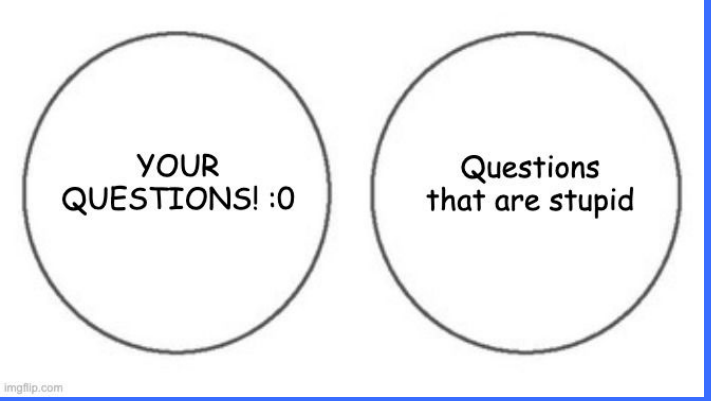
```
marktabor@Marks-MacBook-Pro Lectures % node js1.js
a * b = 50
```

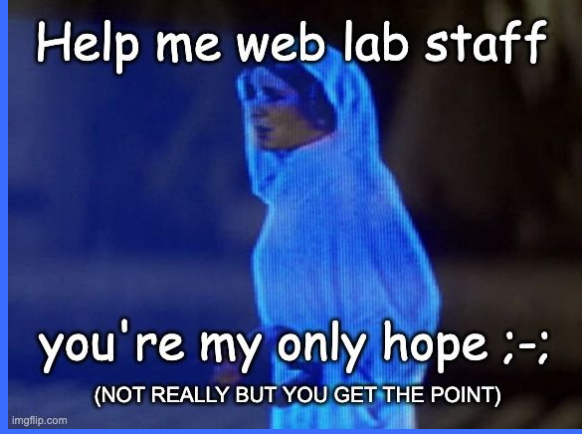
Alerts

`alert()` generates a pop-up notification with the given content.

```
alert("Congratulations!");
```




YOUR QUESTIONS! :0
Questions that are stupid
imgflip.com


Help me web lab staff
you're my only hope ;-;
(NOT REALLY BUT YOU GET THE POINT)
imgflip.com

Questions?


Me learning JavaScript like
[visible confusion]
imgflip.com

Arrays

For when you want to store a sequence of (ideally similar) items:

```
// initialize
let pets = ["flower", 42, false, "bird"]

// access
console.log(pets[3]); // "bird"

// replace
pets[2] = "hamster";  // ["flower", 42, "hamster", "bird"]
```

Arrays

```
// initialize
let pets = ["cat", "dog", "guinea pig", "bird"];

// remove from end
pets.pop(); // ["cat", "dog", "guinea pig"]

// add to end
pets.push("rabbit"); // ["cat", "dog", "guinea pig", "rabbit"]
```

Conditionals

We often want to perform different actions in response to different conditions.

For this, we use the **conditional operators** `if`, `else`, and `else if`:

```
if (hour < 12) {
    console.log("Good morning!");
} else if (hour < 16) {
    console.log("Good afternoon!");
} else if (hour < 20) {
    console.log("Good evening!");
} else {
    console.log("Good night!");
}
```

Conditionals

We often want to perform different actions in response to different conditions.

For this, we use the **conditional operators** `if`, `else`, and `else if`:

Note the indent (tab)! It's not necessary, but it will make your code much more readable.

```
if (hour < 12) {
    console.log("Good morning!");
} else if (hour < 16) {
    console.log("Good afternoon!");
} else if (hour < 20) {
    console.log("Good evening!");
} else {
    console.log("Good night!");
}
```

While loops

What if we want to repeat an action *as long as* some condition is satisfied?

```
let z = 1;

while (z < 1000) {
    z = z * 2;
    console.log(z);
}
```

```
2
4
8
16
32
64
128
256
512
1024
```

For loops

Useful when we want to iterate through indices:

```
I love my cat
I love my dog
I love my guinea pig
I love my bird
```

```
const pets = ["cat", "dog", "guinea pig", "bird"];

for (let i = 0; i < pets.length; i++) {
    const phrase = "I love my " + pets[i];
    console.log(phrase);
}
```

For … of …

A more “pythonic” way of iterating:

```
I love my cat
I love my dog
I love my guinea pig
I love my bird
```

Requires the keyword **of** instead of **in**

```
const pets = ["cat", "dog", "guinea pig", "bird"];

for (const animal of pets) {
  const phrase = "I love my " + animal;
  console.log(phrase);
}
```

Questions?

Comments?

Concerns?

Wait, we don’t have a primitive data type for this

Objects

A JavaScript **object** is a collection of `name:value` pairs.

Accessing properties

There are two ways to access object properties, if you know the property name:

```
const myCar = {
    make    : "Ford",
    model   : "Mustang",
    year    : 2005,
    color   : "red"
};

console.log(myCar.model);    // "Mustang"
console.log(myCar["color"]); // "red"
```

Object destructuring

Object destructuring is a shorthand to obtain multiple properties at once.

Object destructuring

Object destructuring is a shorthand to obtain multiple properties at once.

without object destructuring

```
const myCar = {
    make    : "Ford",
    model   : "Mustang",
    year    : 2005,
    color   : "red"
};

const make = myCar.make;
const model = myCar.model;
```

Object destructuring

Object destructuring is a shorthand to obtain multiple properties at once.

without object destructuring

```
const myCar = {
    make    : "Ford",
    model   : "Mustang",
    year    : 2005,
    color   : "red"
};

const make = myCar.make;
const model = myCar.model;
```

with object destructuring

```
const myCar = {
    make    : "Ford",
    model   : "Mustang",
    year    : 2005,
    color   : "red"
};

const { make, model } = myCar;
```

Equality...?

We use === to check if two *primitive* variables are equal in JavaScript.

```
2 === 2;          // true
2 === 3;          // false
"2" === "2";      // true
2 === "2";        // false
```

Equality...?

We use === to check if two *primitive* variables are equal in JavaScript.

```
2 === 2;          // true
2 === 3;          // false
"2" === "2";      // true
2 === "2";        // false
```

But what does === mean for arrays and objects?

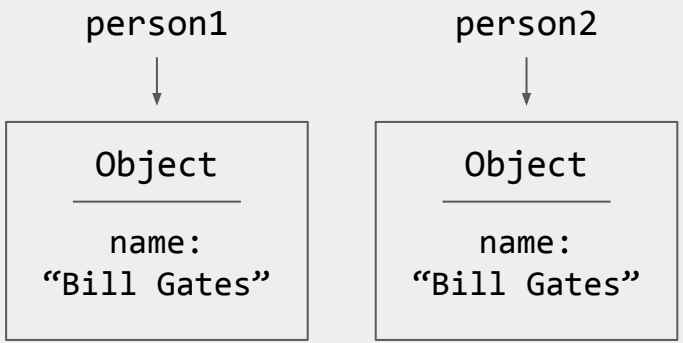
```
let arr1 = [1, 2, 3];
let arr2 = [1, 2, 3];

arr1 === arr2; // false!
```

```
let person1 = { name: "Bill Gates" };
let person2 = { name: "Bill Gates" };

person1 === person2; // false!
```

Object references

Object variables are **references** – they point to where the data is actually stored.

```
let person1 = { name: "Bill Gates" };
let person2 = { name: "Bill Gates" };

person1 === person2; // false!
```



=== checks if the *references* are equal.

Two objects created separately are stored separately, so their references are different!

Same goes for arrays – two arrays created separately have different references.

How to copy arrays and objects

It’s not as simple as

```
let arr = [1, 2, 3];
let copyArr = arr;
```

(Why not?)

How to copy arrays and objects

It's not as simple as

```
let arr = [1, 2, 3];
let copyArr = arr;
```

(Why not?)

One way to copy arrays and objects is to use the **spread** operator (`...`) like so:

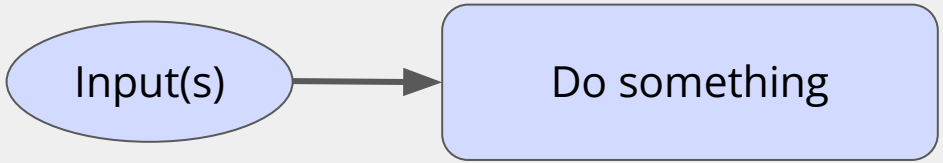
```
let arr = [1, 2, 3];
let copyArr = [...arr];
```

```
let obj = { name: "Bill Gates" };
let copyObj = { ...obj };
```

You could also manually copy over every item / property. But where's the fun in that?

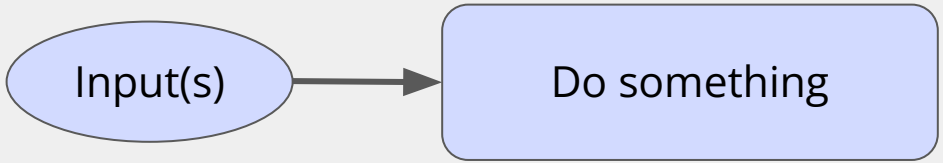
Questions?

Functions



Sometimes, we want the function to **return** an output value.

Functions

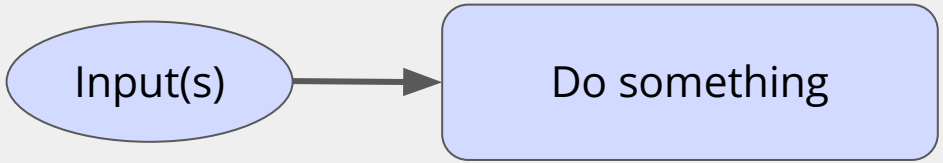


Sometimes, we want the function to **return** an output value.

JS Function Syntax:

```
(parameters) => { body };
```

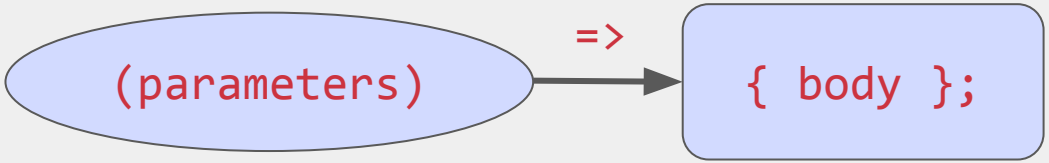
Functions



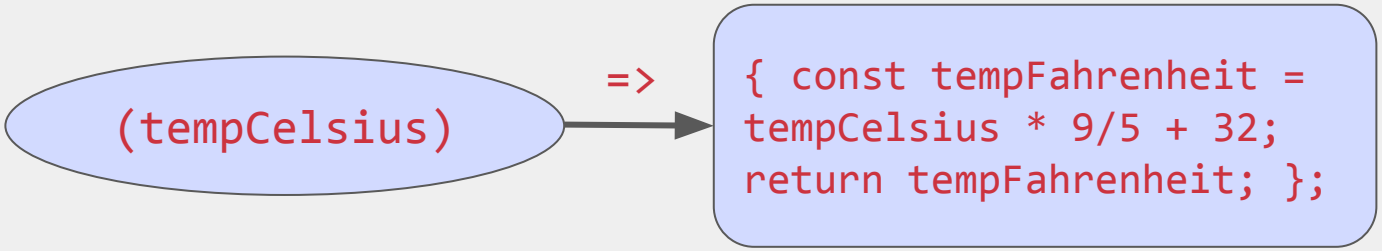
Sometimes, we want the function to **return** an output value.

JS Function Syntax:

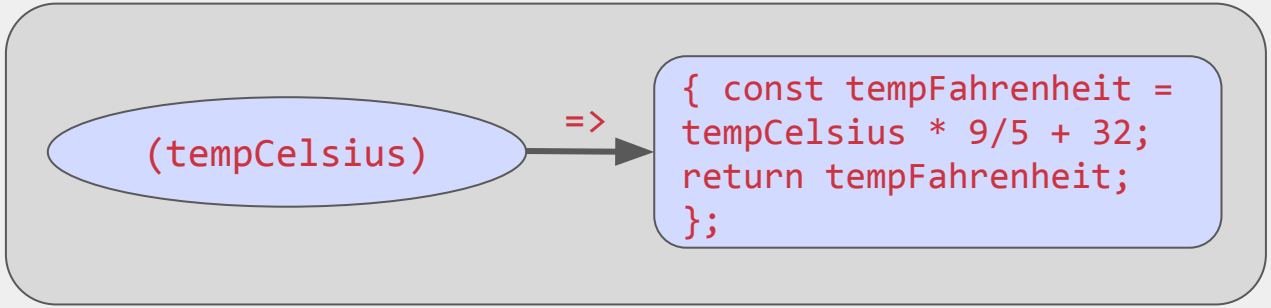
```
(parameters) => { body };
```



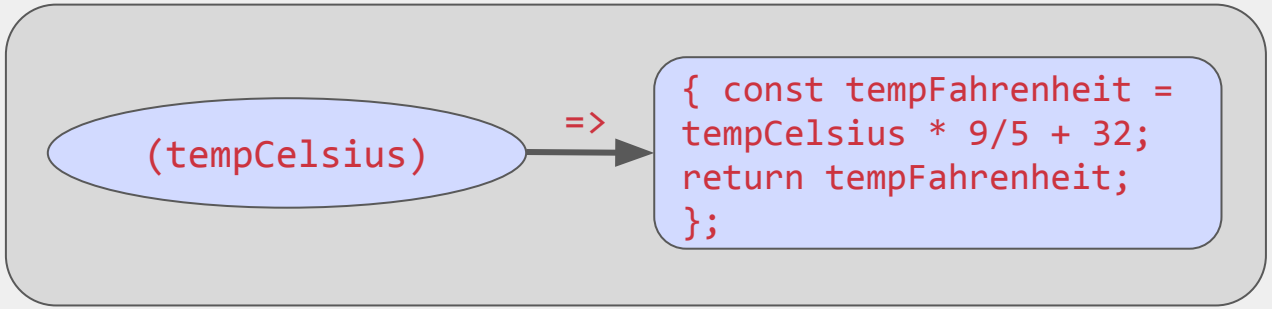
```
(tempCelsius) => {
    const tempFahrenheit = tempCelsius * 9/5 + 32;
    return tempFahrenheit;
}
```



```
(tempCelsius) => {
    const tempFahrenheit = tempCelsius * 9/5 + 32;
    return tempFahrenheit;
}
```

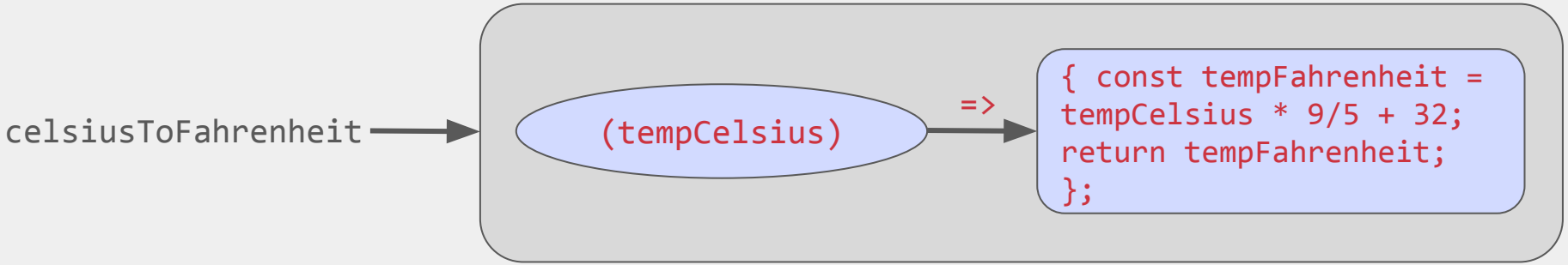


```
(tempCelsius) => {
    const tempFahrenheit = tempCelsius * 9/5 + 32;
    return tempFahrenheit;
}
```

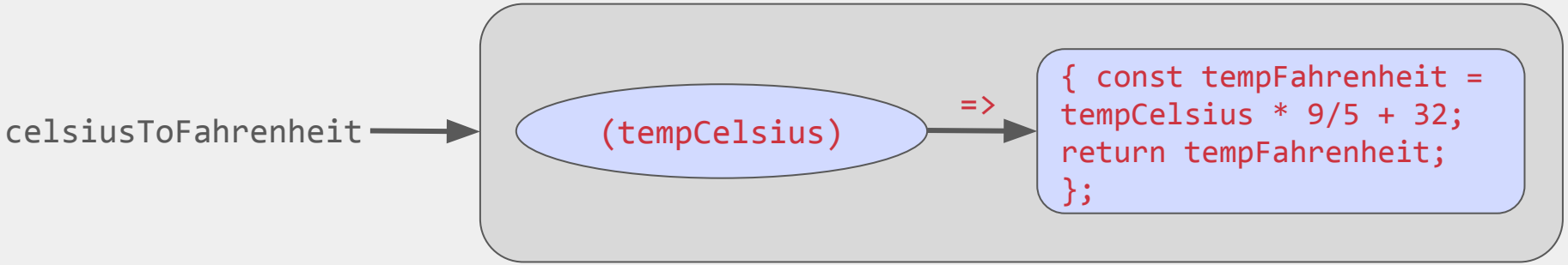


What do we need to add so we can call this function?

```
(tempCelsius) => {
    const tempFahrenheit = tempCelsius * 9/5 + 32;
    return tempFahrenheit;
}
```

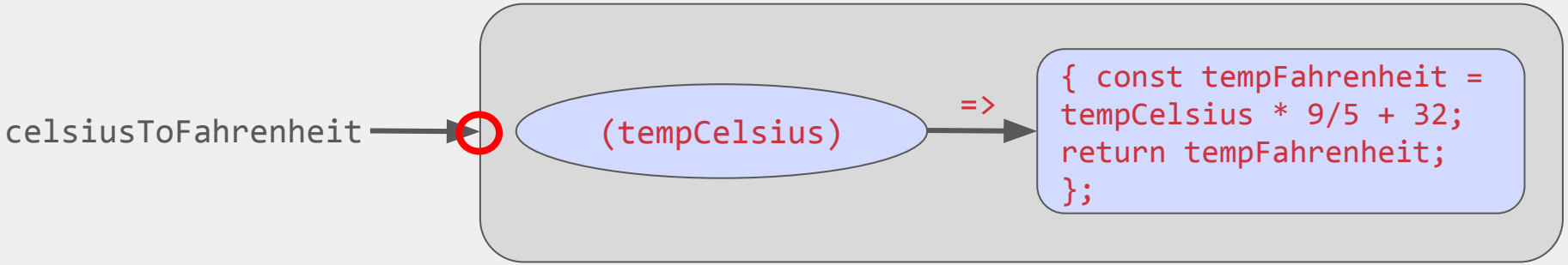


```
(tempCelsius) => {
    const tempFahrenheit = tempCelsius * 9/5 + 32;
    return tempFahrenheit;
}
```



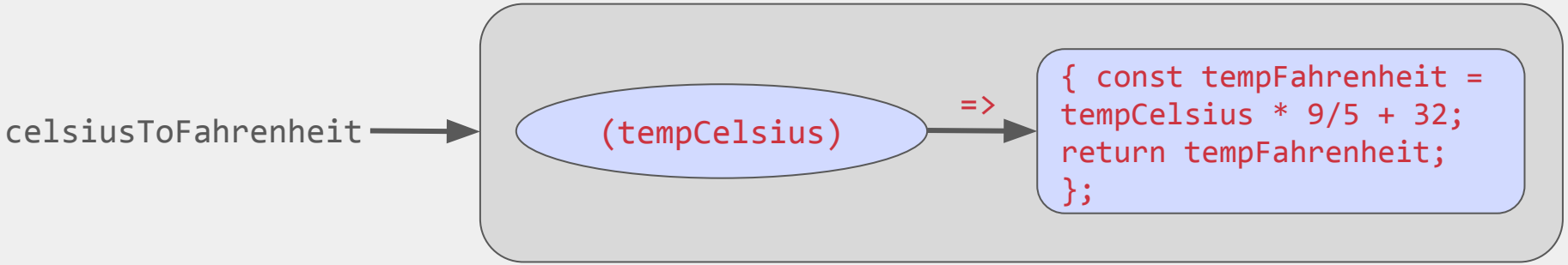

```
const celsiusToFahrenheit = (tempCelsius) => {
    const tempFahrenheit = tempCelsius * 9/5 + 32;
    return tempFahrenheit;
};
```

```
(tempCelsius) => {
    const tempFahrenheit = tempCelsius * 9/5 + 32;
    return tempFahrenheit;
}
```



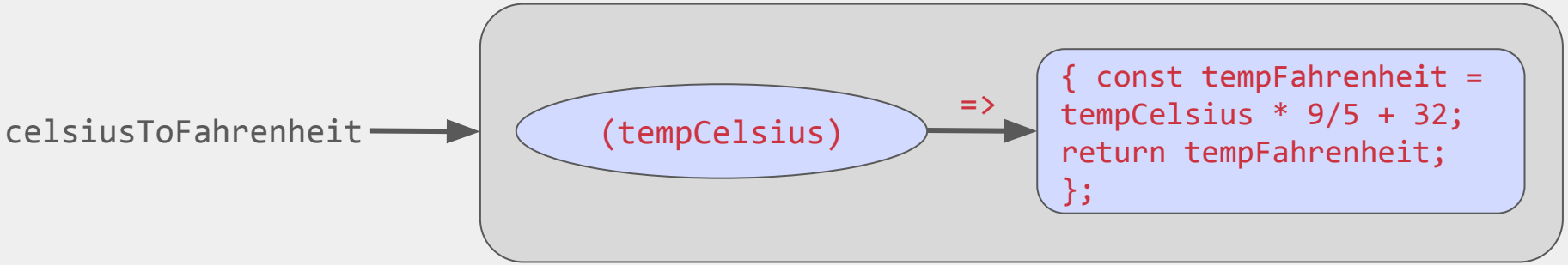

```
const celsiusToFahrenheit = (tempCelsius) => {
    const tempFahrenheit = tempCelsius * 9/5 + 32;
    return tempFahrenheit;
};
```

```
(tempCelsius) => {
    const tempFahrenheit = tempCelsius * 9/5 + 32;
    return tempFahrenheit;
}
```



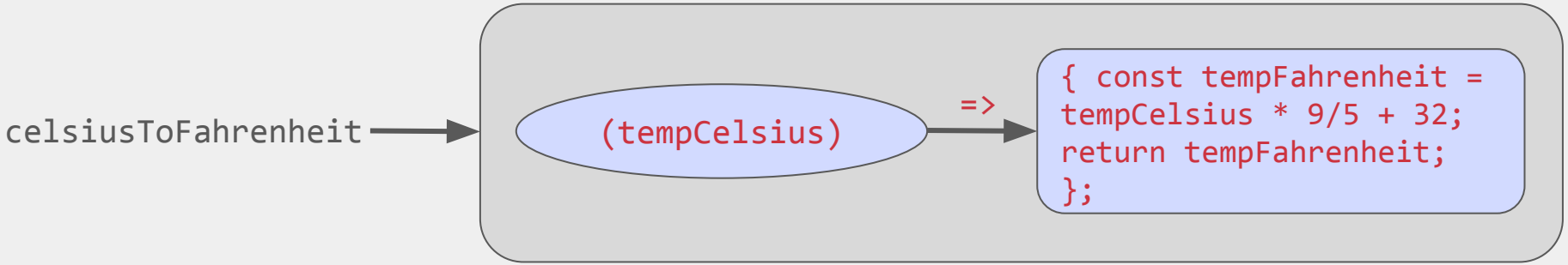

```
const celsiusToFahrenheit = (tempCelsius) => {
    const tempFahrenheit = tempCelsius * 9/5 + 32;
    return tempFahrenheit;
};
```

```
(tempCelsius) => {
    const tempFahrenheit = tempCelsius * 9/5 + 32;
    return tempFahrenheit;
}
```



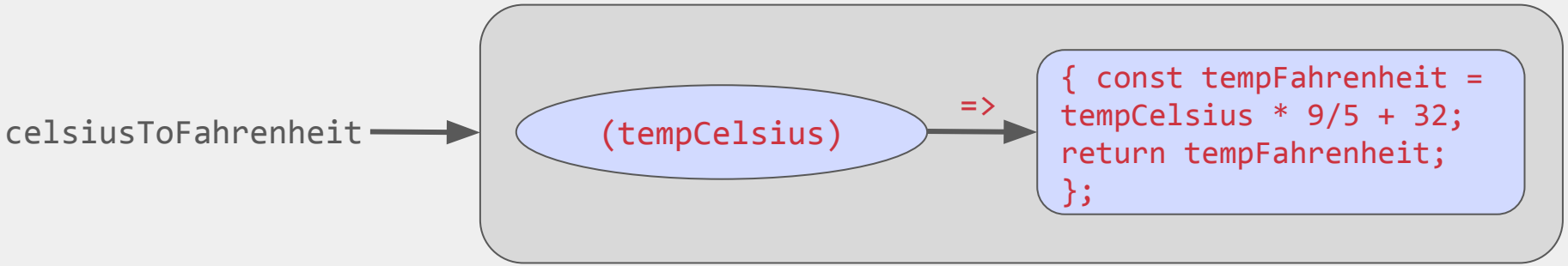

```
const celsiusToFahrenheit = (tempCelsius) => {
    const tempFahrenheit = tempCelsius * 9/5 + 32;
    return tempFahrenheit;
};
```

```
(tempCelsius) => {
    const tempFahrenheit = tempCelsius * 9/5 + 32;
    return tempFahrenheit;
}
```



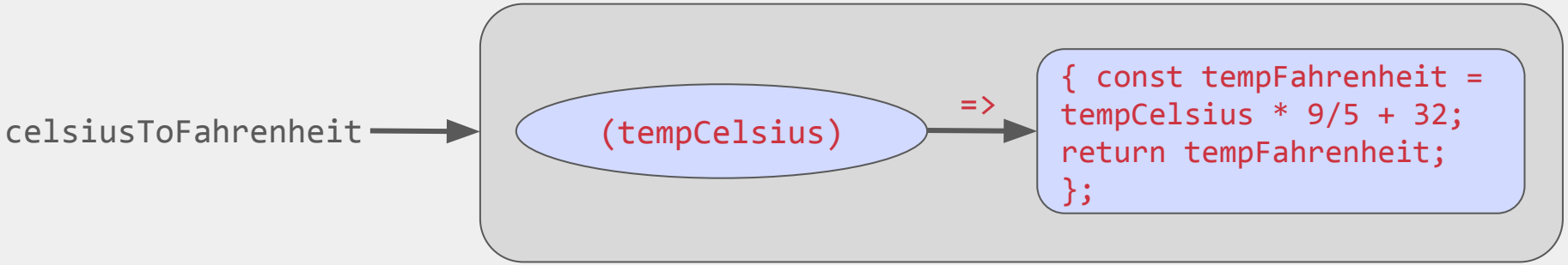

```
const celsiusToFahrenheit = (tempCelsius) => {
    const tempFahrenheit = tempCelsius * 9/5 + 32;
    return tempFahrenheit;
};
```

```
(tempCelsius) => {
    const tempFahrenheit = tempCelsius * 9/5 + 32;
    return tempFahrenheit;
}
```




```
const celsiusToFahrenheit = (tempCelsius) => {
    const tempFahrenheit = tempCelsius * 9/5 + 32;
    return tempFahrenheit;
};
```

Functions are values stored in memory, just like strings, ints, etc. So we can assign variables to point to them!




```
const roomTemp = celsiusToFahrenheit(26); // will assign 78.8 to roomTemp
```

Callback functions

In JavaScript, functions can be passed around like any other values.

This means we can give a **“callback”** function as an argument to another function!

Quick Practice!

Write a function that prints a simple message to the console.

Syntax reference:

`(parameters) => { body };` (but we don’t need any parameters)

```
console.log(“your message”);
```

Remember to give your function a name!

Example: setTimeout

```
const printSomething = () => {
    console.log("i sleep");
}
```

setTimeout() calls a function after a specified delay. It takes 2 parameters: the function to call (aka callback function), and the delay (in milliseconds).

Example: setTimeout

```
const printSomething = () => {
    console.log("i sleep");
}
```

setTimeout() calls a function after a specified delay. It takes 2 parameters: the function to call (aka callback function), and the delay (in milliseconds).

How can we print our message after 5 seconds? (multiple-select)

A. `setTimeout(printSomething, 5000);`

B. `setTimeout(printSomething(), 5000);`

C. `setTimeout(() => { console.log("i sleep"); }, 5000);`

Example: setTimeout

```
const printSomething = () => {
    console.log("i sleep");
};
```

setTimeout() calls a function after a specified delay. It takes 2 parameters: the function to call, and the delay (in milliseconds).

How can we print our message after 5 seconds?

A.
```
setTimeout(printSomething, 5000);
```

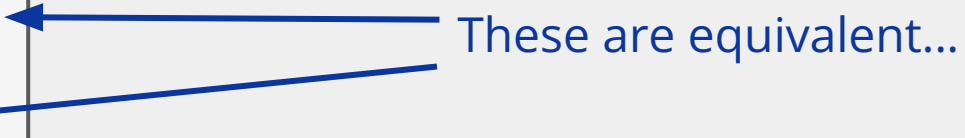
B.
```
setTimeout(printSomething(), 5000);
```

DON'T DO THIS! printSomething() is whatever printSomething **returns**, not the function itself

C.
```
setTimeout(() => { console.log("i sleep"); }, 5000);
```

What's going on in Option C?

```
const tempC = 26;
let tempF = celsiusToFahrenheit(tempC);

tempF = celsiusToFahrenheit(26);
```



What's going on in Option C?

```
const tempC = 26;
let tempF = celsiusToFahrenheit(tempC);

tempF = celsiusToFahrenheit(26);
```

These are equivalent...

```
const printSomething = () => {
    console.log("i sleep");
};
setTimeout(printSomething, 5000);

setTimeout(() => { console.log("i sleep"); }, 5000);
```

And so are these!

What's going on in Option C?

```
const tempC = 26;
let tempF = celsiusToFahrenheit(tempC);

tempF = celsiusToFahrenheit(26);
```

These are equivalent...

```
const printSomething = () => {
    console.log("i sleep");
};
setTimeout(printSomething, 5000);

setTimeout(() => { console.log("i sleep"); }, 5000);
```

And so are these!
(the highlighted parts are the same)

setInterval() vs. setTimeout()

setInterval()

Repeatedly calls a function with a delay between each call

Returns an intervalID which can be passed into **clearInterval()** to terminate

Arguments: func, delay, arg0, ..., argN

setTimeout()

Sets a timer that executes a function when the timer ends

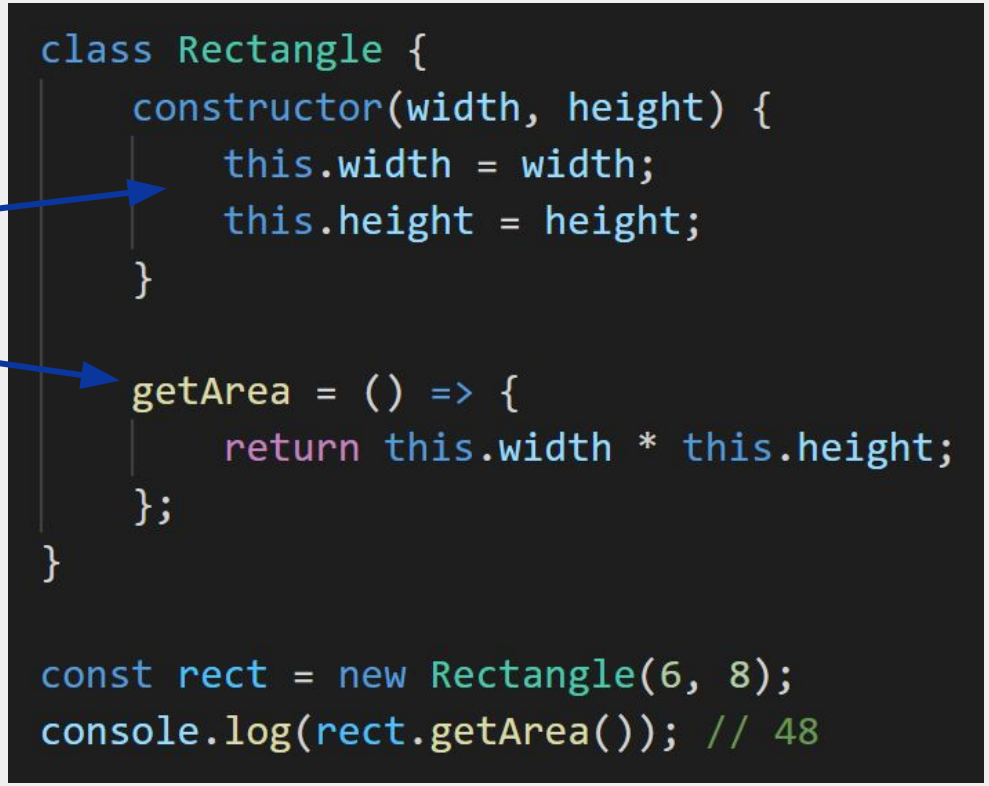
Returns an intervalID which can be passed into **clearTimeout()** to cancel the timer

Arguments: func, delay, arg0, ..., argN

Check out MDN docs for more info!

Classes

Classes are used when we have multiple objects that all represent the same type of thing. They let us define the **attributes** and **methods** that every object of that type, or class, has.



```
class Rectangle {
    constructor(width, height) {
        this.width = width;
        this.height = height;
    }

    getArea = () => {
        return this.width * this.height;
    };
}

const rect = new Rectangle(6, 8);
console.log(rect.getArea()); // 48
```

Summary

JavaScript is how we make things happen!

- Declare variables using let, const.
- boolean, number, string, null, undefined
- functions, arrays, objects, classes
- if, else, while, for
- setInterval() vs. setTimeout()

Up next: hands-on JavaScript workshop!

Questions?

Announcements

- Hw0 (Setup) weblab.is/home
  - Also has a link to flexbox froggy if you want to learn about/practice CSS flexbox!
  - Need to install Node by tomorrow!
- Office Hours tonight 7-9pm in 32-082!
  - Come for setup issues, or if you're new to programming and want to go over javascript or git!
- Milestone 0 (find a team and brainstorm 10 ideas) due eod Wednesday
- Recordings from today will be available as soon as we edit + post them (hopefully this evening). Slides and other links are all at weblab.is/home
- team formation mixer (right now! :D find teammates!)
- Give us feedback 👉👈 (weblab.is/feedback)

Theme: "Send it or blend it"