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2020

# JavaScript (Part 2)

**“The” language of the Web**

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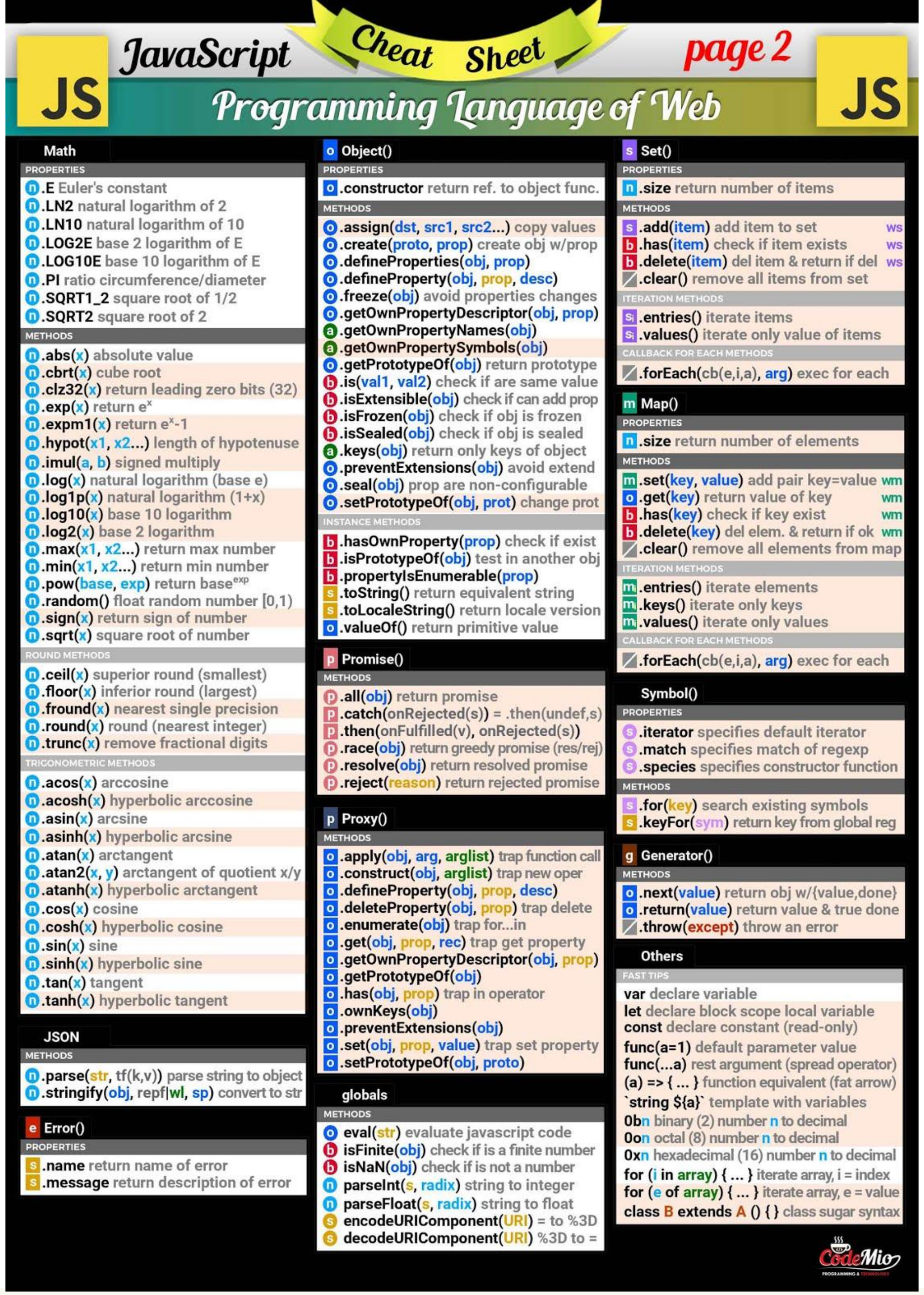

JavaScript Cheat Sheet page 2

JS Programming Language of Web JS

**Math**

PROPERTIES

- .E Euler's constant
- .LN2 natural logarithm of 2
- .LN10 natural logarithm of 10
- .LOG2E base 2 logarithm of E
- .LOG10E base 10 logarithm of E
- .PI ratio circumference/diameter
- .SQRT1_2 square root of 1/2
- .SQRT2 square root of 2

METHODS

- .abs(x) absolute value
- .cbrt(x) cube root
- .clz32(x) return leading zero bits (32)
- .exp(x) return $e^x$
- .expm1(x) return $e^x$-1
- .hypot(x1, x2...) length of hypotenuse
- .imul(a, b) signed multiply
- .log(x) natural logarithm (base e)
- .log1p(x) natural logarithm (1+x)
- .log10(x) base 10 logarithm
- .log2(x) base 2 logarithm
- .max(x1, x2...) return max number
- .min(x1, x2...) return min number
- .pow(base, exp) return $base^{exp}$
- .random() float random number [0,1)
- .sign(x) return sign of number
- .sqrt(x) square root of number

ROUND METHODS

- .ceil(x) superior round (smallest)
- .floor(x) inferior round (largest)
- .fround(x) nearest single precision
- .round(x) round (nearest integer)
- .trunc(x) remove fractional digits

TRIGONOMETRIC METHODS

- .acos(x) arccosine
- .acosh(x) hyperbolic arccosine
- .asin(x) arcsine
- .asinh(x) hyperbolic arcsine
- .atan(x) arctangent
- .atan2(x, y) arctangent of quotient x/y
- .atanh(x) hyperbolic arctangent
- .cos(x) cosine
- .cosh(x) hyperbolic cosine
- .sin(x) sine
- .sinh(x) hyperbolic sine
- .tan(x) tangent
- .tanh(x) hyperbolic tangent

**JSON**

METHODS

- .parse(str, tf(k,v)) parse string to object
- .stringify(obj, repf|wl, sp) convert to str

**Error()**

PROPERTIES

- .name return name of error
- .message return description of error

**Object()**

PROPERTIES

- .constructor return ref. to object func.

METHODS

- .assign(dst, src1, src2...) copy values
- .create(proto, prop) create obj w/prop
- .defineProperties(obj, prop)
- .defineProperty(obj, prop, desc)
- .freeze(obj) avoid properties changes
- .getOwnPropertyDescriptor(obj, prop)
- .getOwnPropertyNames(obj)
- .getOwnPropertySymbols(obj)
- .getPrototypeOf(obj) return prototype
- .is(val1, val2) check if are same value
- .isExtensible(obj) check if can add prop
- .isFrozen(obj) check if obj is frozen
- .isSealed(obj) check if obj is sealed
- .keys(obj) return only keys of object
- .preventExtensions(obj) avoid extend
- .seal(obj) prop are non-configurable
- .setPrototypeOf(obj, prot) change prot

INSTANCE METHODS

- .hasOwnProperty(prop) check if exist
- .isPrototypeOf(obj) test in another obj
- .propertyIsEnumerable(prop)
- .toString() return equivalent string
- .toLocaleString() return locale version
- .valueOf() return primitive value

**Promise()**

METHODS

- .all(obj) return promise
- .catch(onRejected(s)) = .then(undef,s)
- .then(onFulfilled(v), onRejected(s))
- .race(obj) return greedy promise (res/rej)
- .resolve(obj) return resolved promise
- .reject(reason) return rejected promise

**Proxy()**

METHODS

- .apply(obj, arg, arglist) trap function call
- .construct(obj, arglist) trap new oper
- .defineProperty(obj, prop, desc)
- .deleteProperty(obj, prop) trap delete
- .enumerate(obj) trap for...in
- .get(obj, prop, rec) trap get property
- .getOwnPropertyDescriptor(obj, prop)
- .getPrototypeOf(obj)
- .has(obj, prop) trap in operator
- .ownKeys(obj)
- .preventExtensions(obj)
- .set(obj, prop, value) trap set property
- .setPrototypeOf(obj, proto)

**globals**

METHODS

- eval(str) evaluate javascript code
- isFinite(obj) check if is a finite number
- isNaN(obj) check if is not a number
- parseInt(s, radix) string to integer
- parseFloat(s, radix) string to float
- encodeURIComponent(URI) = to %3D
- decodeURIComponent(URI) %3D to =

**Set()**

PROPERTIES

- .size return number of items

METHODS

- .add(item) add item to set ws
- .has(item) check if item exists ws
- .delete(item) del item & return if del ws
- .clear() remove all items from set

ITERATION METHODS

- .entries() iterate items
- .values() iterate only value of items

CALLBACK FOR EACH METHODS

- .forEach(cb(e,i,a), arg) exec for each

**Map()**

PROPERTIES

- .size return number of elements

METHODS

- .set(key, value) add pair key=value wm
- .get(key) return value of key wm
- .has(key) check if key exist wm
- .delete(key) del elem. & return if ok wm
- .clear() remove all elements from map

ITERATION METHODS

- .entries() iterate elements
- .keys() iterate only keys
- .values() iterate only values

CALLBACK FOR EACH METHODS

- .forEach(cb(e,i,a), arg) exec for each

**Symbol()**

PROPERTIES

- .iterator specifies default iterator
- .match specifies match of regexp
- .species specifies constructor function

METHODS

- .for(key) search existing symbols
- .keyFor(sym) return key from global reg

**Generator()**

METHODS

- .next(value) return obj w/{value,done}
- .return(value) return value & true done
- .throw(except) throw an error

**Others**

FAST TIPS

- var declare variable
- let declare block scope local variable
- const declare constant (read-only)
- func(a=1) default parameter value
- func(...a) rest argument (spread operator)
- (a) => { ... } function equivalent (fat arrow)
- \`string ${a}\` template with variables
- 0bn binary (2) number n to decimal
- 0on octal (8) number n to decimal
- 0xn hexadecimal (16) number n to decimal
- for (i in array) { ... } iterate array, i = index
- for (e of array) { ... } iterate array, e = value
- class B extends A () { } class sugar syntax

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## Outline

- Objects
- Functions
  - Closures
- Callbacks
  - Timers
- Dates

JavaScript: The Definitive Guide, 7th Edition
Chapter 5. Objects

Mozilla Developer Network

- Learn web development JavaScript » Dynamic client-side scripting » Introducing JavaScript objects
- Web technology for developers » JavaScript » JavaScript reference » Standard built-in objects » Object
- Web technology for developers » JavaScript » JavaScript reference » Expressions and operators » in operator

JavaScript – The language of the Web

# OBJECTS

# Big Warnings *(a.k.a., forget Java objects)*

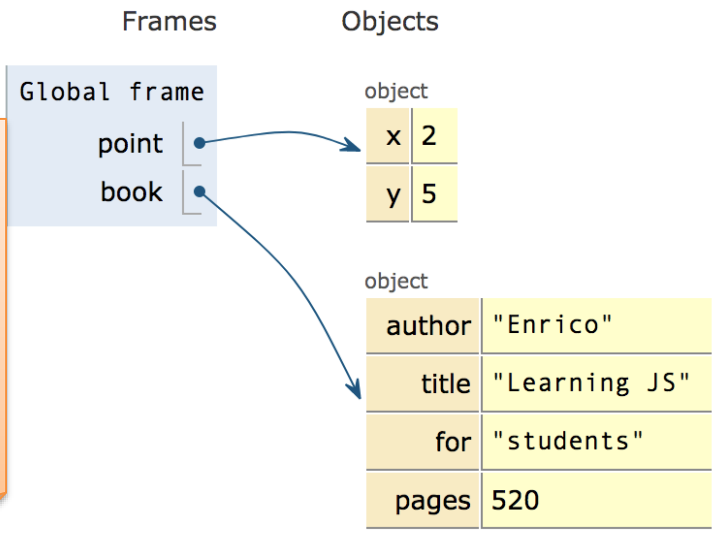
- In JavaScript, Objects may exist without Classes
  - Usually, Objects are created directly, without deriving them from a Class definition
- In JavaScript, Objects are dynamic
  - You may add, delete, redefine a *property* at any time
  - You may add, delete, redefine a *method* at any time
- In JavaScript, there are no access control methods
  - Every property and every method is always public (private/protected don't exist)
- There is no real difference between properties and methods (because of how JS functions work)

# Objects

- An object is an unordered collection of properties
  - Each property has a **name** (key), and a **value**
- Store and retrieve *property values*, through the *property names*
- Object creation and initialization:

```
let point = { x: 2, y: 5 };

let book = {
  author : "Enrico",
  title : "Learning JS",
  for: "students",
  pages: 520,
};
```

Object literals syntax:
```
{"name": value,
"name": value, }
```
or:
```
{name: value,
name: value, }
```



## Object Properties

**Property names are …**

- Identified as a string
- Must be unique in each object
- Created at object initialization
- Added after object creation
  - With assignment
- Deleted after object creation
  - With `delete` operator

**Property values are …**

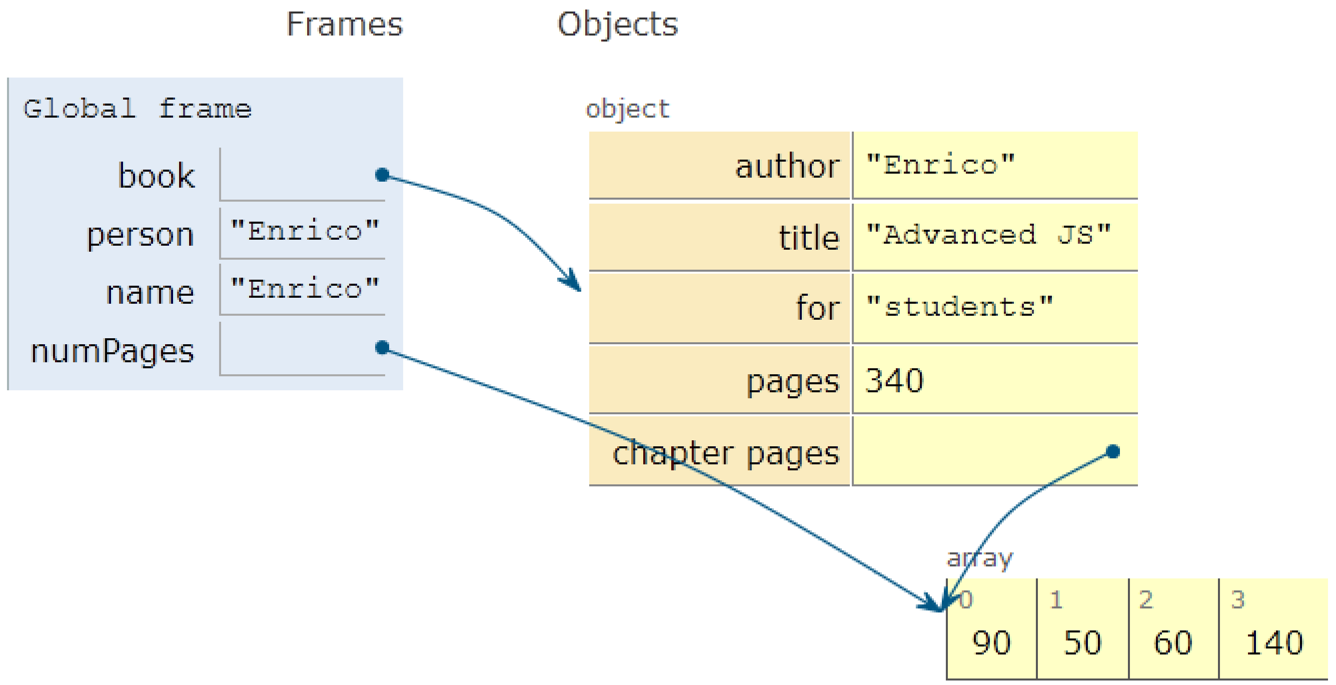
- References to JS values
- Stored inside the object
- May be primitive types
- May be arrays, other objects, …
  - Beware: the object stores the reference, the value is *outside*
- May be functions (*methods*)

# Accessing properties

- Dot (.) or square brackets [] notation

The . dot notation and omitting the quotes are allowed when the property name is a valid identifier, only.
`book.title` or `book['title']`
`book['my title']` and not ~~`book.my title`~~

```
let book = {
  author : "Enrico",
  title : "Learning JS",
  for: "students",
  pages: 340,
  "chapter pages": [90,50,60,140]
};

let person = book.author;
let name = book["author"];
let numPages =
    book["chapter pages"];
book.title = "Advanced JS";
book["pages"] = 340;
```



# Objects as associative arrays

- The `[ ]` syntax looks like array access, but the index is *a string*
  - Generally known as *associative arrays*
- Setting a non-existing property creates it:
  - `person["telephone"] = "0110901234";`
  - `person.telephone = "0110901234";`
- Deleting properties
  - `delete person.telephone;`
  - `delete person["telephone"];`

# Property names may be computed strings

- Flexibility in accessing array properties
  - Access `i`-th line of object person address: `person["address"+i]`
  - Not really recommended…
- Beware of quotes:
  - `book["title"]` -> property called `title`
    - Equivalent to `book.title`
  - `book[title]` -> property called with the value of variable `title` (if exists)
    - If `title=="author"`, then equivalente to `book["author"]`
    - No equivalent in dot-notation

## Property access errors

- If a property is not defined, the (attempted) access returns undefined
- If unsure, must check before accessing

```
let surname = undefined;
if (book) {
    if (book.author) {
        surname = book.author.surname;
    }
}
```

```
surname = book && book.author && book.author.surname;
```

## Iterating over properties

- `for .. in` iterates over the properties

```
for( let a in {x: 0, y:3}) {
     console.log(a) ;
}
```

```
x
y
```

```
let book = {
  author : "Enrico",
  pages: 340,
  chapterPages: [90,50,60,140],
};

for (const prop in book)
  console.log(`${prop} = ${book[prop]}`);
```

```
author = Enrico
pages = 340
chapterPages = 90,50,60,140
```

# Iterating over properties

- All the (enumerable) properties names (keys) of an object can be accessed as an array, with:
  - `let keys = Object.keys(my_object) ;`

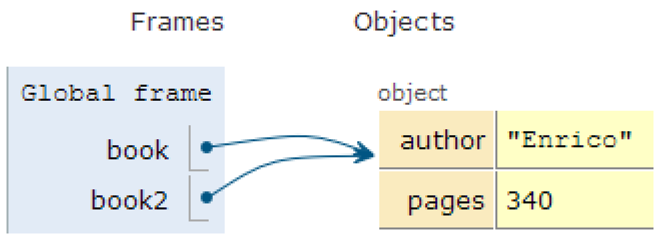
```
[ 'author', 'pages' ]
```

- All pairs [key, value] are returned as an array with:
  - `let keys_values = Object.entries(my_object)`

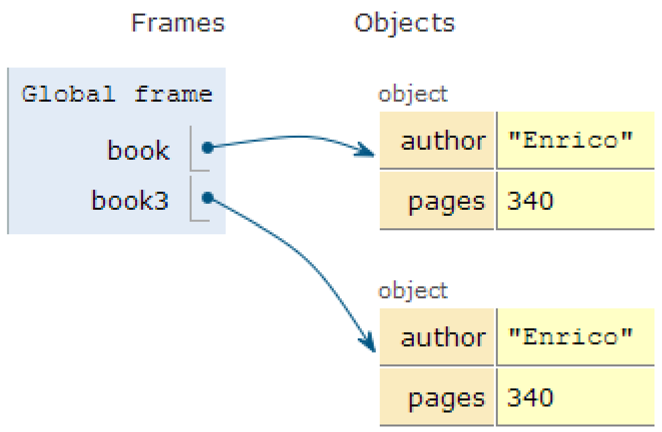
```
[ [ 'author', 'Enrico' ], [ 'pages', 340 ] ]
```

# Copying objects

```
let book = {
  author : "Enrico",
  pages: 340,
};

let book2 = book;
```



```
let book = {
  author : "Enrico",
  pages: 340,
};

let book3 =
   Object.assign({}, book);
```



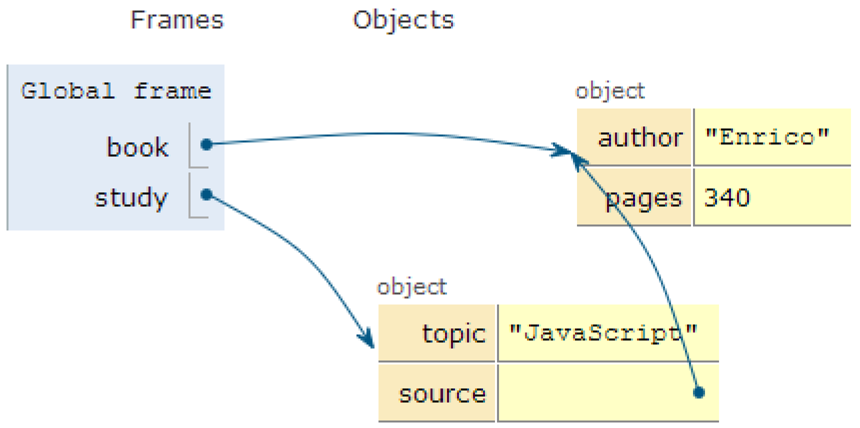
# Object.assign

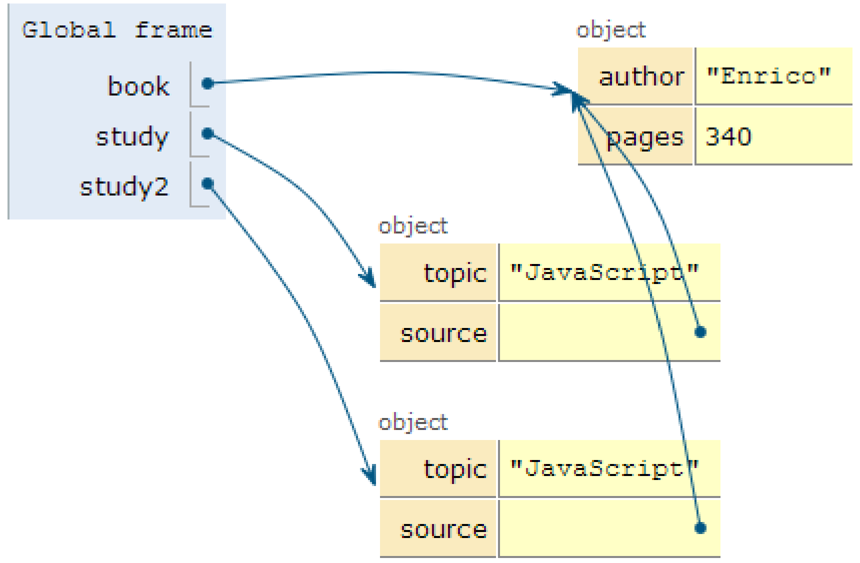
- `let new_object = Object.assign(target, source);`
- Assigns all the properties from the source object to the target one
- The target may be an existing object
- The target may be a new object: `{}`
- Returns the target object (after modification)

## Beware! Shallow copy, only

```
let book = {
  author : "Enrico",
  pages: 340,
};

let study = {
  topic: "JavaScript",
  source: book,
};
```

```
let study2 = Object.assign({},
study);
```

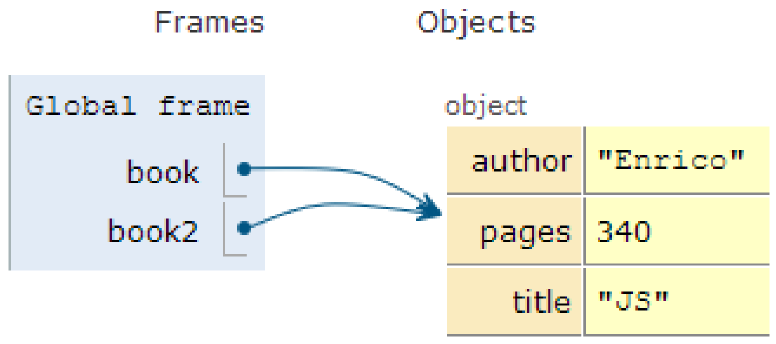




# Merge properties (on existing object)

- `Object.assign(target, source, default values, ..);`

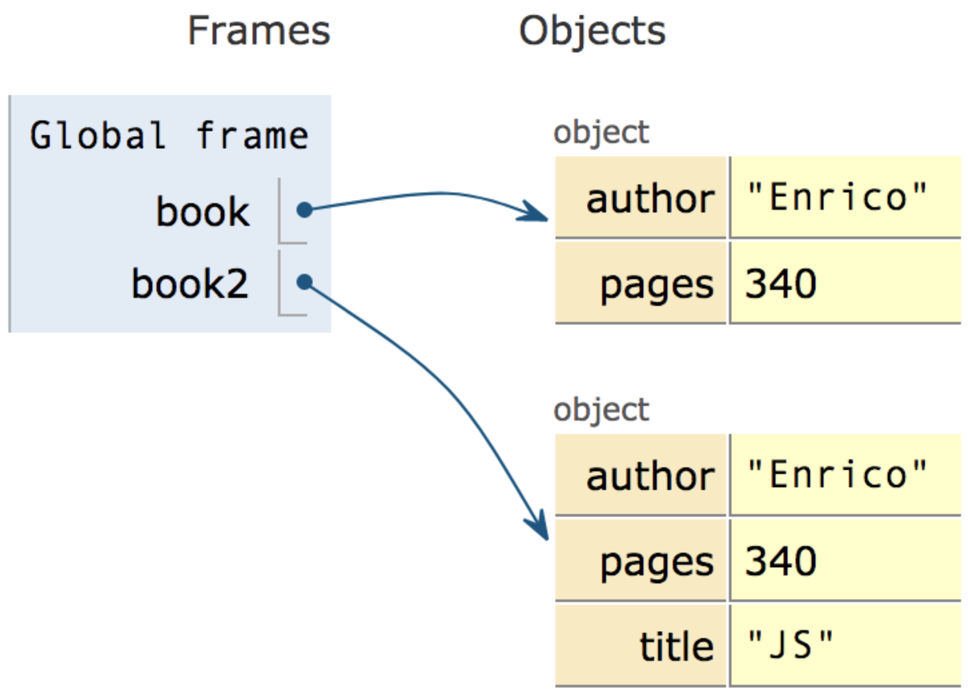
```
let book = {
  author : "Enrico",
  pages: 340,
};

let book2 = Object.assign(
 book, {title: "JS"}
);
```



# Merge properties (on new object)

- `Object.assign(target, source, default values, ..);`

```
let book = {
  author : "Enrico",
  pages: 340,
};

let book2 = Object.assign(
 {}, book, {title: "JS"}
);
```



## Copying with spread operator (**ES9** – ES2018 )

```
let book = {
  author : "Enrico",
  pages: 340,
};

let book2 = {...book, title: "JS"};

console.log(book2);
```

```
{ author: 'Enrico', pages: 340, title: 'JS' }
```

```
const {a,b,...others} =
   {a:1, b:2, c:3, d:4};

console.log(a);
console.log(b);
console.log(others);
```

```
1
2
{ c: 3, d: 4 }
```

## Checking if properties exist

- Operator `in`
  - Returns true if property is in the object. Do <u>not</u> use with Array

```
let book = {
  author : "Enrico",
  pages: 340,
};

console.log('author' in book);
delete book.author;
console.log('author' in book);
```

```
true
false
```

```
const v=['a','b','c’];

console.log('b' in v);



console.log('PI' in Math);
```

```
false
true
```

## Object creation (equivalent methods)

- By object literal: `const point = {x:2, y:5} ;`
- By object literal (empty object): `const point = {} ;`

Preferred

- By constructor: `const point = new Object() ;`
- By object static method create:
  `const point = Object.create({x:2,y:5}) ;`
- Using a *constructor function*

# Construction functions

- Define the object type by writing a constructor function.
  - Use a capital initial letter
- Create an instance of the object with new.

```
function Car(make, model, year) {
  this.make = make;
  this.model = model;
  this.year = year;
}
```

```
let mycar = new Car('Eagle',
'Talon TSi', 1993);
```

JavaScript: The Definitive Guide, 7th Edition
Chapter 7. Functions

JavaScript – The language of the Web

## FUNCTIONS

## Functions

- One of the most important elements in JavaScript
- Delimits a block of code with a private scope
- Can accept parameters and returns one value
  - Can also be an object
- Functions themselves **are objects** in JavaScript
  - They can be assigned to a variable
  - Can be passed as an argument
  - Used as a return value

## Declaring functions: 3 ways

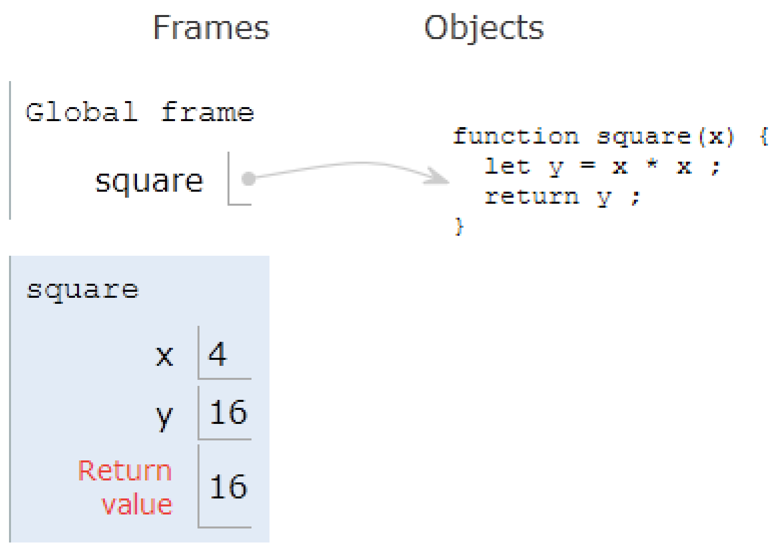
1) Classic

```
function do(params) {
  /* do something */
}
```

# Classic functions

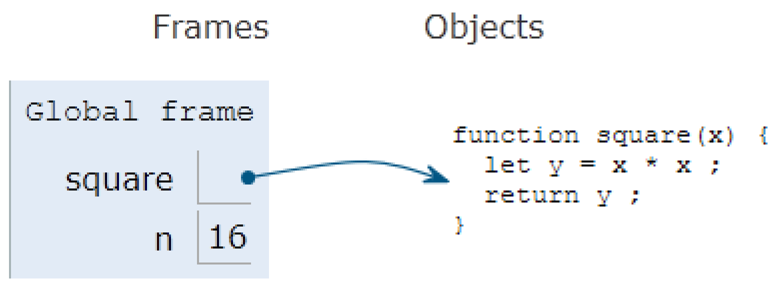
```
function square(x) {
  let y = x * x ;
  return y ;
}

let n = square(4) ;
```

During execution



```
function square(x) {
  let y = x * x ;
  return y ;
}
```

After execution



```
function square(x) {
  let y = x * x ;
  return y ;
}
```

## Parameters

- Comma-separated list of parameter names
  - May assign a default value, e.g. `function(a, b=1) {}`
- Parameters are passed by-value
  - Copies of the reference to the object
- Parameters that are not passed in the function call get the value ‘`undefined`’
- Check missing/optional parameters with:
  - `if(p===undefined) p = default_value ;`
  - `p = p || default_value ;`

## Variable number of parameters

- Syntax for functions with variable number of parameters, using the . . . operator (called “rest”)

```
function fun (par1, par2, ...arr) { }
```

- The "rest" parameter must be the last, and will deposit all extra arguments into an array

```
function sumAll(initVal, ...arr) {
  let sum = initVal;
  for (let a of arr) sum += a;
  return sum;
}
sumAll(0, 2, 4, 5); // 11
```

## Declaring functions: 3 ways

1) Classic

```
function do(params) {
  /* do something */
}
```

2a) Function expression

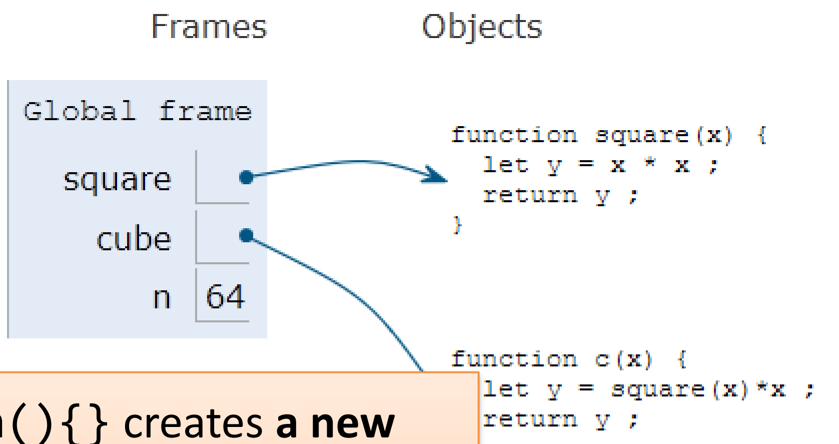
```
const fn = function(params) {
  /* do something */
}
```

2b) Named function expression

```
const fn = function do(params) {
  /* do something */
}
```

# Function expression: indistinguishable

```
function square(x) {
  let y = x * x ;
  return y ;
}

let cube = function c(x) {
  let y = square(x)*x ;
  return y ;
}

let n = cube(4) ;
```



```
function square(x) {
  let y = x * x ;
  return y ;
}
```

```
function c(x) {
  let y = square(x)*x ;
  return y ;
```

The *expression* `function(){}` creates **a new object of type 'function'** and returns the result.

Any variable may "refer" to the function and call it. You can also store that reference into an array, an object property, pass it as a parameter to a function, redefine it, …

method

callback

## Declaring functions: 3 ways

1) Classic

```
function do(params) {
  /* do something */
}
```

2a) Function expression

```
const fn = function(params) {
  /* do something */
}
```

3) Arrow function

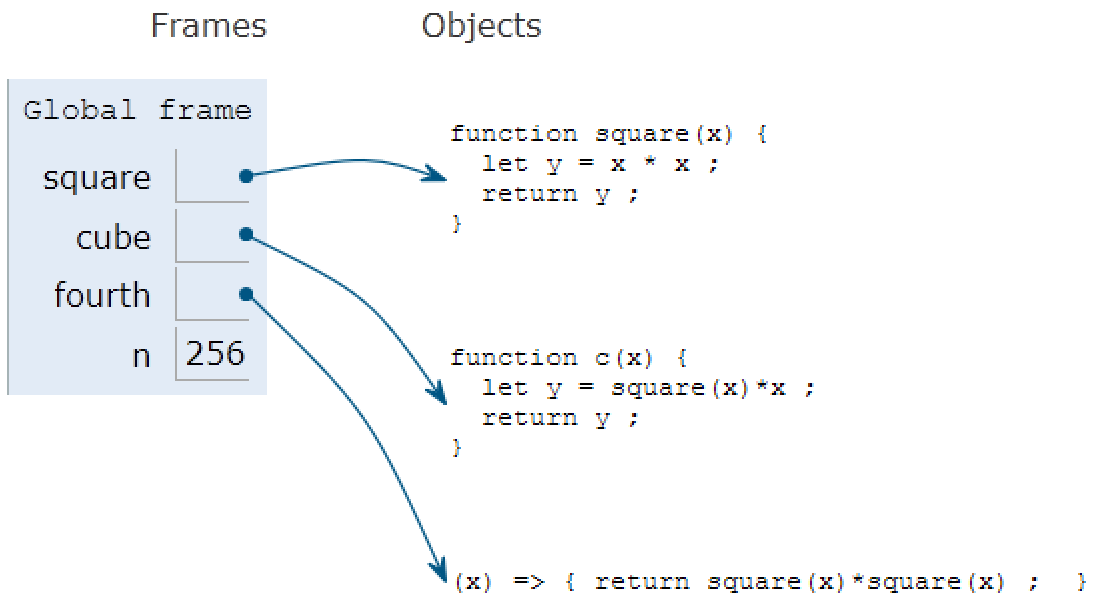
```
const fn = (params) => {
  /* do something */
}
```

2b) Named function expression

```
const fn = function do(params) {
  /* do something */
}
```

# Arrow Function: just a shortcut

```
function square(x) {
  let y = x * x ;
  return y ;
}

let cube = function c(x) {
  let y = square(x)*x ;
  return y ;
}

let fourth = (x) => { return
square(x)*square(x) ;  }

let n = fourth(4) ;
```



```
function square(x) {
  let y = x * x ;
  return y ;
}
```

```
function c(x) {
  let y = square(x)*x ;
  return y ;
}
```

```
(x) => { return square(x)*square(x) ;  }
```

## Parameters in arrow functions

```
const fun = () => {  /* do something */ }          // no params

const fun = param => {  /* do something */ }       // 1 param

const fun = (param) => {  /* do something */ }     // 1 param

const fun = (par1, par2) => {  /* smtg */ } // 2 params

const fun = (par1 = 1, par2 = 'abc') => {  /* smtg */ }   // default values
```

## Return value

- Default: `undefined`
- Use `return` to return a value
- Only one value can be returned
- However, objects (or arrays) can be returned

```
const fun = () => {  return ['hello', 5] ; }
const [ str, num ] = fun() ;
console.log(str) ;
```

- Arrow functions have implicit return if there is only one value

```
let fourth = (x) => { return square(x)*square(x) ;  }
let fourth = x => square(x)*square(x) ;
```

# Nested functions

- Function can be nested, i.e., defined within another function

```
function hypotenuse(a, b) {
    const square = x => x*x ;
    return Math.sqrt(square(a) + square(b));
}
```

=> Preferred in nested functions

```
function hypotenuse(a, b) {
    function square(x) { return x*x; }
    return Math.sqrt(square(a) + square(b));
}
```

- The inner function is *scoped within* the external function and cannot be called outside
- The inner function might *access variables declared* in the *outside* function

## Closure: definition (somewhat cryptic)

A closure is a name given to a feature in the language by which a nested function executed after the execution of the outer function can still access outer function's scope.

Really: one of the most important concepts in JS

https://medium.com/@vvkchandra/learn-javascript-closures-through-the-laws-of-karma-49d32d35b3f7

# Closures

- JS uses *lexical scoping*
  - Each new functions defines a *scope* for the variables declared inside
  - Nested functions may access the scope of *all enclosing* functions
- Every function object remembers the scope where it is defined, even after the external function is no longer active → Closure

```
"use strict" ;

function greeter(name) {
    const myname = name ;

    const hello = function () {
        return "Hello " + myname ;
    }

    return hello ;
}

const helloTom = greeter("Tom") ;
const helloJerry = greeter("Jerry") ;

console.log(helloTom()) ;
console.log(helloJerry()) ;
```

Warning: not `return hello() ;`

## Closures

- `hello` accesses the variable `myname`, defined in the outer scope
- The function is returned (as `helloTom` or `helloJerry`)
- Each of the functions “remembers” the reference to `myname`, when it was defined
- The variable `myname` goes out of scope, but is not destroyed
  - Still accessible (referred) by the `hello` functions.

```
"use strict" ;

function greeter(name) {
    const myname = name ;

    const hello = function () {
        return "Hello " + myname ;
    }

    return hello ;
}

const helloTom = greeter("Tom") ;
const helloJerry = greeter("Jerry") ;

console.log(helloTom()) ;
console.log(helloJerry()) ;
```

greeter scope

hello scope

## Using closures to emulate objects

```
"use strict" ;

function counter() {
    let value = 0 ;

    const getNext = () => {
        value++;
        return value;
    }

    return getNext ;
}
```

```
const count1 = counter() ;
console.log(count1()) ;
console.log(count1()) ;
console.log(count1()) ;

const count2 = counter() ;
console.log(count2()) ;
console.log(count2()) ;
console.log(count2()) ;
```

```
1
2
3
1
2
3
```

# Using closures to emulate objects (with methods)

```
"use strict";

function counter() {
    let n = 0;

    // return an object,
    // containing two function-valued
    // properties
    return {
        count: function() {
            return n++; },
        reset: function() { n = 0; }
    };
}
```

```
let c = counter(), d = counter();
        // Create two counters

c.count()
        // => 0

d.count()
        // => 0: they count independently

c.reset()
        // reset() and count() methods

c.count()
        // => 0: because we reset c

d.count()
        // => 1: d was not reset
```

## Immediately Invoked Function Expressions (IIFE)

- Functions may protect the *scope* of variables and inner functions
- May declare a function
  - With internal variables
  - With inner functions
  - Call it only once, and discard everything

```
( function() {
    let a = 3 ;
    console.log(a) ;
} ) () ;
```

```
let num = ( function() {
    let a = 3 ;
    return a ;
} ) () ;
```

https://flaviocopes.com/javascript-iife/

https://medium.com/@vvkchandra/essential-javascript-mastering-immediately-invoked-function-expressions-67791338ddc6

## Using IIFE to emulate objects (with methods)

```
"use strict";

const c = (
    function () {
        let n = 0;

        return {
            count: function () {
                return n++; },
            reset: function () {
                n = 0; }
        };
    })();
```

```
console.log(c.count());
console.log(c.count());
c.reset();
console.log(c.count());
console.log(c.count());
```

```
0
1
0
1
```

11.1 Asynchronous Programming with Callbacks

JavaScript – The language of the Web

## CALLBACKS

## Callbacks

- A callback function is a function passed into another function as an argument, which is then invoked inside the outer function to complete some kind of routine or action.
  - Synchronous
  - Asynchronous

```
function greeting(name) {
  alert('Hello ' + name);
}

function
processUserInput(callback) {
  var name = prompt('name:');
  callback(name);
}

processUserInput(greeting);
```

https://developer.mozilla.org/en-US/docs/Glossary/Callback_function

# Synchronous callbacks

- Used in functional programming
  - E.g., providing the sort criteria for array sorting

```
var numbers = [4, 2, 5, 1, 3];

numbers.sort(function(a, b) {
  return a - b;
});

console.log(numbers);
```

```
let numbers = [4, 2, 5, 1, 3];

numbers.sort((a, b) => a - b);

console.log(numbers);
```

## Synchronous callbacks

- Example: filter according to a criteria
  - filter() creates a **new** array with all elements for which the callback returns true

```
const market = [
  { name: 'GOOG', var: -3.2 },
  { name: 'AMZN', var:  2.2 },
  { name: 'MSFT', var: -1.8 }
];

const bad = market.filter(stock => stock.var < 0);
// [ { name: 'GOOG', var: -3.2 }, { name: 'MSFT', var: -1.8 } ]

const good = market.filter(stock => stock.var > 0);
// [ { name: 'AMZN', var: 2.2 } ]
```

## Asynchronous callbacks

- Handling user actions
  - E.g., button click
- Handling I/O operations
  - E.g., fetch a document
- Handling time intervals
  - E.g., timers

## Timers

- Useful to delay the execution of a function. Two possibilities from the runtime environment
  - `setTimeout()` runs the callback function after a given period of time
  - `setInterval()` runs the callback function periodically

```
const onesec = setTimeout(()=> {
    console.log('hey’) ; // after 1s
}, 1000) ;

console.log('hi') ;
```

```
const myFunction = (firstParam,
secondParam) => {
  // do something
}
// runs after 2 seconds
setTimeout(myFunction, 2000,
firstParam, secondParam)
```

## Timers

- `clearInterval()`: for stopping the periodical invocation of `setInterval`

```
const id = setInterval(() => {}, 2000) ;

// «id» is a handle that refers to the timer

clearInterval(id) ;
```

JavaScript: The Definitive Guide, 7th Edition
Chapter 9.4 Dates and Times

Mozilla Developer Network
Web technology for developers » JavaScript »
JavaScript reference »
Standard built-in objects » Date

JavaScript – The language of the Web

## DATES

# Date object

- Store a time instant with *millisecond* precision, counted from Jan 1, 1970 UTC (Unix Epoch)
- Careful with time zones
  - Most methods work in local time (not UTC) the computer is set to

```
let now = Date();
```

```
let newYearMorning = new Date(
2020, // Year 2020
0, // January (from 0)
1, // 1st
18, 15, 10, 743);
// 18:15:10.743, local time
```

# Creating dates with `new Date()`

1. No parameters:
   that represents
2. A number parar
   represents the r
   Jan 1970 00:00
3. A string, which represents a formatted date
4. A se ers, which repr arts of a date
   – At least 3 values: y, m, d

UTC vs Local time zone are confusing.

```
> new Date('2020-03-18')
2020-03-18T00:00:00.000Z
> new Date('18 March 2020')
2020-03-17T23:00:00.000Z
```

Remember the **`new`** keyword

```
new Date();
 new Date(1530826365*1000);
ne = new Date('Mar 16, 2020');
es = new Date('3/16/2020');
// careful with day/month order!
```

Formatting is locale-dependent 😱

```
let newYearAfternoon = new Date(
2020, // Year 2020
0, // January (from 0)
1, // 1st
18);
// 18:00:00.000, local time
```

https://flaviocopes.com/javascript-dates/

## Date transformation

- `Date.parse()`
  - Static method, returns a timestamp in ms, not a Date object
  - A lot of string formats supported, as for the constructor parameter
- Edit fields in the date
  - get and set methods
- to...String()
  - to obtain human-readable dates
- getTime()
  - to get timestamp in ms

```
let ts1 = Date.parse('Mon 16 2020');
let ts2 = Date.parse('2020-03-16 09:35:22');
let ts3 = Date.parse('3/16/2020');
let ts4 = Date.parse('2020 MARCH');
```

```
let now = Date();
let day = now.getDate() // 1-31
let dow = now.getDay() // 0=Sunday 6=Saturday
let month = now.getMonth() // 0=January
let time = now.getTime() // ms since Jan 1, 1970

now.setDate(1);
now.setMonth(0);  // First day/month of year

now.toDateString(); // 'Tue Mon 16 2020'

let ts = now.getTime();  // 1584367882000
```

https://flaviocopes.com/javascript-dates/

# Date handling

- Comparing dates
  - Compare timestamp in ms
  - Potentially resetting some date fields (time, in case comparison is about date only)
- Date difference
  - Convert to timestamp, then handle accordingly to get the desired number of days, hours, minutes etc. needed

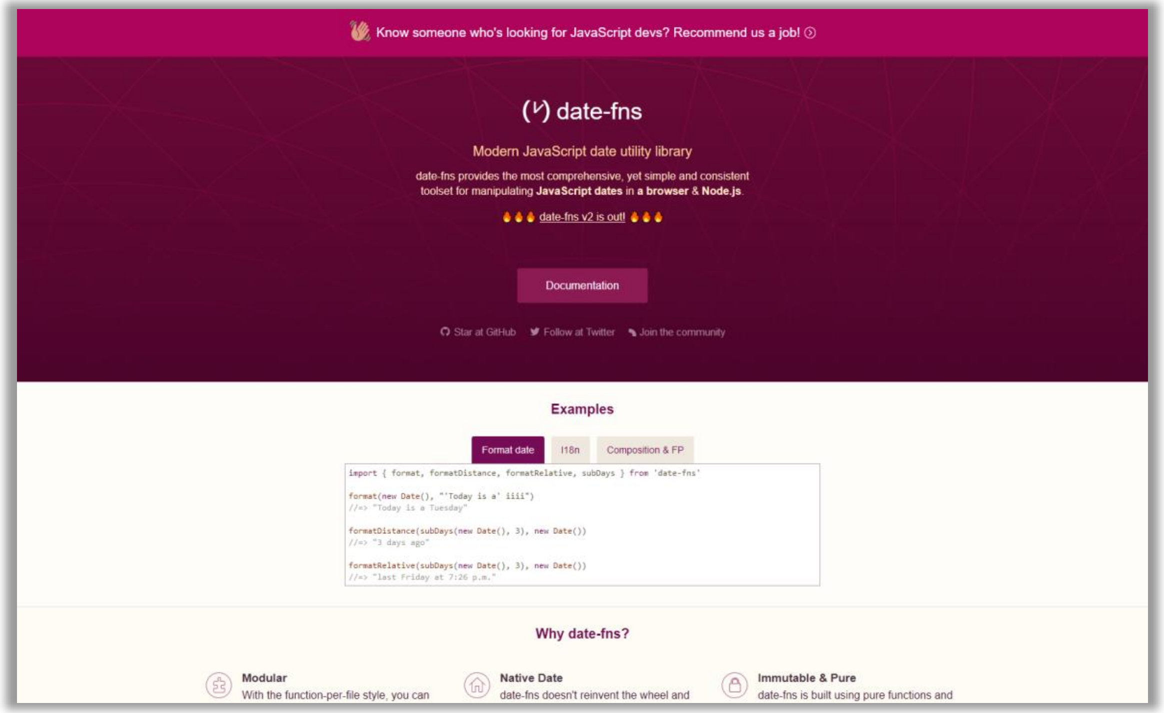
```
const diff = date2.getTime() - date1.getTime()
// in ms

if (date2.getTime() === date1.getTime()) {
  //dates (including times) are equal
}
```

Mar 16, 2020 12:45:23 is **not** equal to new Mar 16, 2020.
Use setHours(0, 0, 0, 0) to reset the time.

```
let d1 = new Date();  //  assume Mar 16, 2020
let d2 = new Date("Jan 1, 2020");
let diff = d1 - d2;
const MS_DAY = 1000*60*60*24;
const MS_H = 1000*60*60;
let days = Math.floor(diff/MS_DAY);  // 75
let mins = Math.floor((diff-days*MS_DAY)/MS_H);
```

https://flaviocopes.com/javascript-dates/

# Serious JS date/time handling libraries



Modern JavaScript date utility library

date-fns provides the most comprehensive, yet simple and consistent toolset for manipulating **JavaScript dates** in **a browser** & **Node.js**.

🔥🔥🔥 date-fns v2 is out! 🔥🔥🔥

Examples

```
import { format, formatDistance, formatRelative, subDays } from 'date-fns'

format(new Date(), "'Today is a' iiii")
//=> "Today is a Tuesday"

formatDistance(subDays(new Date(), 3), new Date())
//=> "3 days ago"

formatRelative(subDays(new Date(), 3), new Date())
//=> "last Friday at 7:26 p.m."
```

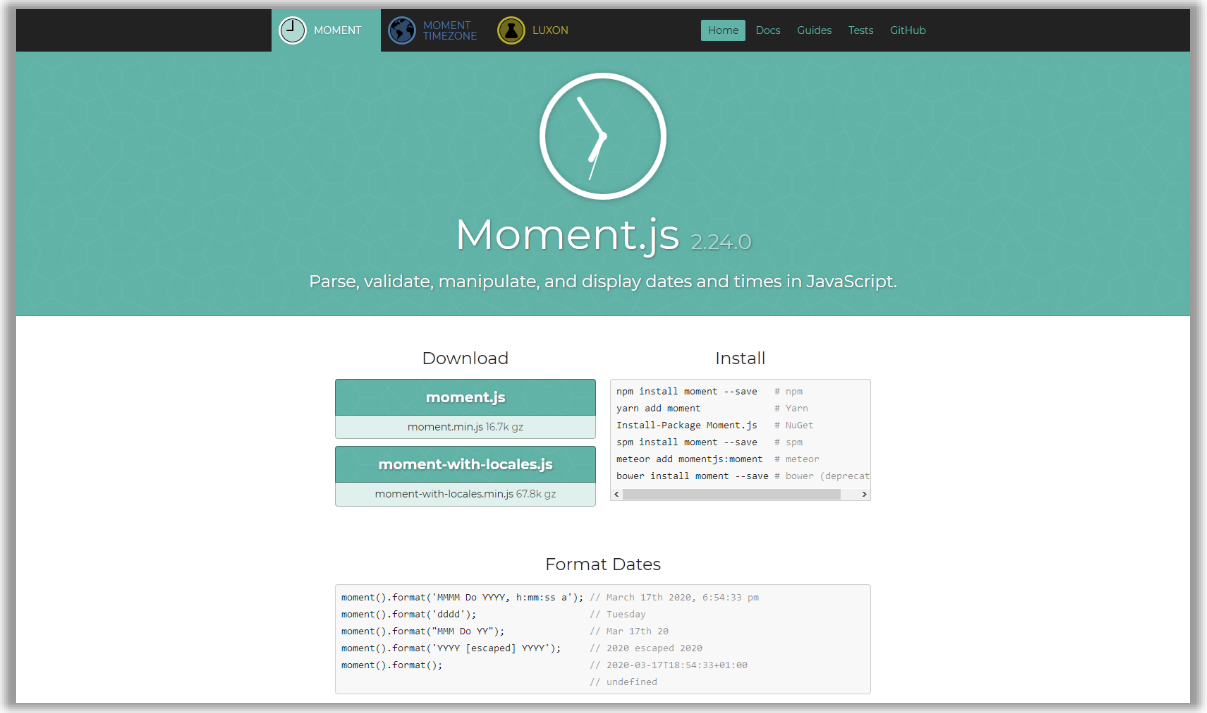
Why date-fns?

**Modular**
With the function-per-file style, you can

**Native Date**
date-fns doesn't reinvent the wheel and

**Immutable & Pure**
date-fns is built using pure functions and

https://date-fns.org/



Moment.js 2.24.0

Parse, validate, manipulate, and display dates and times in JavaScript.

Download

Install

```
npm install moment --save    # npm
yarn add moment              # Yarn
Install-Package Moment.js    # NuGet
spm install moment --save    # spm
meteor add momentjs:moment   # meteor
bower install moment --save # bower (deprecat
```

Format Dates

```
moment().format('MMMM Do YYYY, h:mm:ss a'); // March 17th 2020, 6:54:33 pm
moment().format('dddd');                    // Tuesday
moment().format("MMM Do YY");               // Mar 17th 20
moment().format('YYYY [escaped] YYYY');     // 2020 escaped 2020
moment().format();                          // 2020-03-17T18:54:33+01:00
                                            // undefined
```

https://momentjs.com/

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