Web Application Development

ERROR HANDLING & DEBUGGING

JavaScript can be hard to learn.

Everyone makes mistakes when writing it.

Error messages can help you understand what has gone wrong and how to fix it.

This lecture introduces:

The console and developer tools
Common problems
Handling errors

HOW JAVASCRIPT WORKS

To find the source of an error it helps to understand how scripts are processed.

The order of execution is the order in which lines of code are executed or run.

LOOK AT THIS SCRIPT:

```
    function greetUser() {
  return 'Hello ' + getName();
}

function getName() {
  var name = 'Molly';
  return name;
}

var greeting = greetUser();
alert(greeting);
```

```
    function greetUser() {
  return 'Hello ' + getName();
}

function getName() {
    var name = 'Molly';
    return name;
}

1 var greeting = greetUser();
  alert(greeting);
```

```
② function greetUser() {
  return 'Hello ' + getName();
}

function getName() {
  var name = 'Molly';
  return name;
}

var greeting = greetUser();
alert(greeting);
```

```
    function greetUser() {
  return 'Hello ' + getName();
}

function getName() {
  var name = 'Molly';
  return name;
}

var greeting = greetUser();
alert(greeting);
```

3

```
    function greetUser() {
  return 'Hello ' + getName();
}

function getName() {
    var name = 'Molly';
    return name;
}

var greeting = greetUser();
alert(greeting);
```

4

There are execution contexts:

One global context

And a new execution context for each new function

GLOBAL CONTEXT
(global scope)

FUNCTION CONTEXT
(function-level scope)

```
  function greetUser() {
  return 'Hello ' + getName();
}

function getName() {
  var name = 'Molly';
  return name;
}

var greeting = greetUser();
alert(greeting);
```

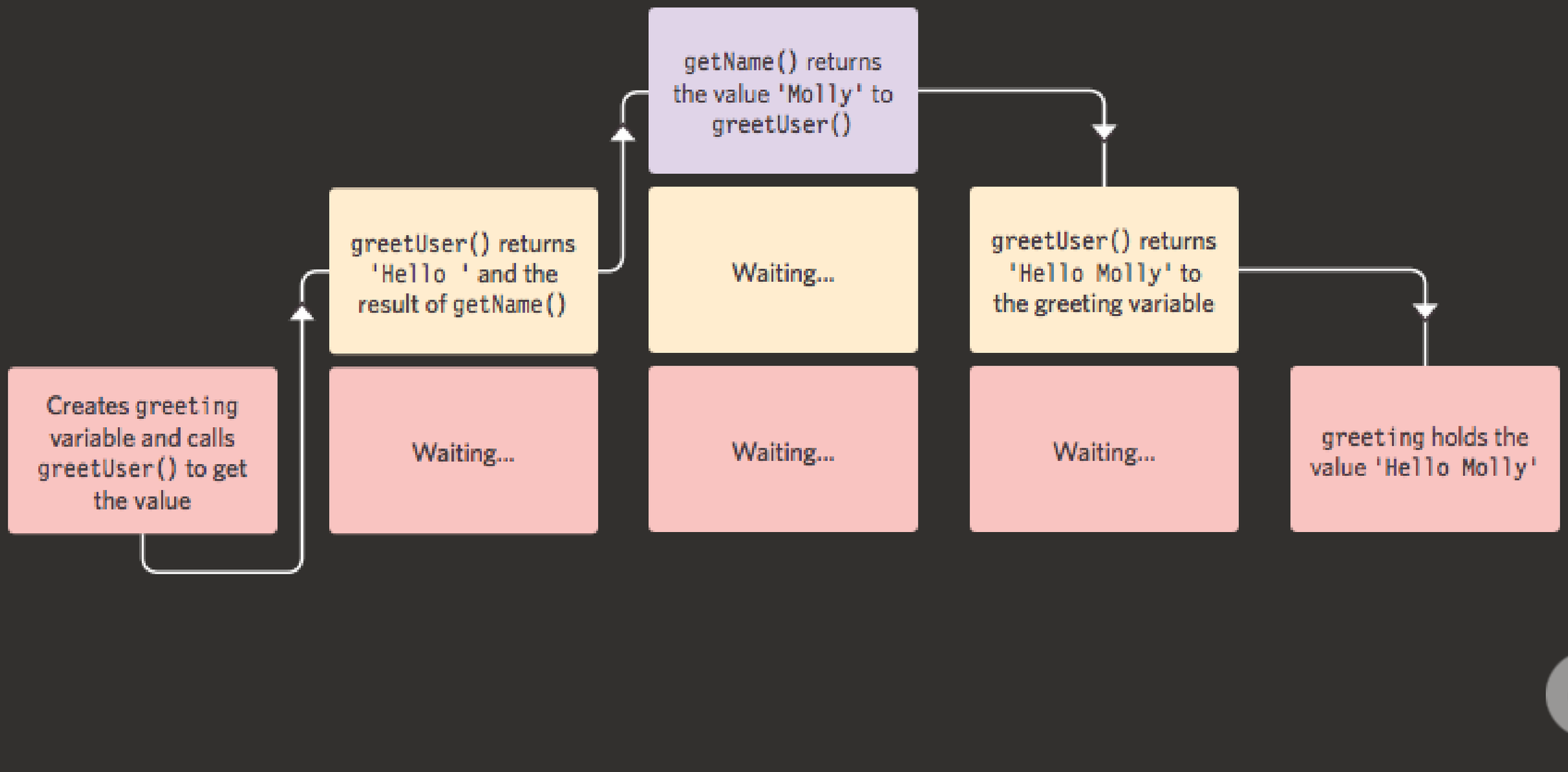
The JavaScript interpreter processes code one line at a time.

If a statement needs data from another function, it stacks (or piles) functions on top of the current task.

```
function greetUser() {
  return 'Hello ' + getName();
}
```

```
function getName() {
  var name = 'Molly';
  return name;
}
```

```
var greeting = greetUser();
alert(greeting);
```



When a script enters a new execution context, there are two phases of activity:

1: Prepare
2: Execute

Prepare

- The new scope is created
- Variables, functions, and arguments are created

Execute

- Now it assigns values to variables
- Reference functions and run their code
- Execute statements

Example

```
var greeting = greetUser();

function greetUser(){
  return “hello”;

}

//As javascript executes one line at a time you would expect the above to fail.
```

Example

Due to how its prepared, it will fail as the function and first statement are in the same execution context, so it is treated like this on execution:

```
function greetUser(){
  return “hello”;
}
var greeting = greetUser();
```

ERRORS

If a JavaScript statement generates an error, then it throws an exception.

It stops… and looks for exception handling code.

If error handling code cannot be found in the current function, it goes up a level.

If error handling code cannot be found at all, the script stops running.

An `Error` object is created.

`Error` objects help you find where your errors are.

Browsers have tools to help you read them.

`Error` objects have these properties:

`name`	type of execution
`message`	description of error
`fileName`	name of JavaScript file
`lineNumber`	line number of error

Seven types of `Error` object:

`Error:` (Generic error – the other errors are all based upon this error)
`SyntaxError:` (Syntax has not being followed)
`ReferenceError:` (Tried to reference an error that is not in scope)
`TypeError:` (An unexpected data type that cannot be coerced)
`RangeError:` (Numbers not in acceptable range)
`URIError:` (encodeURI(), decodeURI(), and similar methods used incorrectly)
`EvalError:` (eval() function used incorrectly)

A DEBUGGING WORKFLOW

Debugging is about deduction and eliminating potential causes of errors.

To find out where the problem is, you can check…

- The error message
- The line number
- The type of error

2

How far the script has run

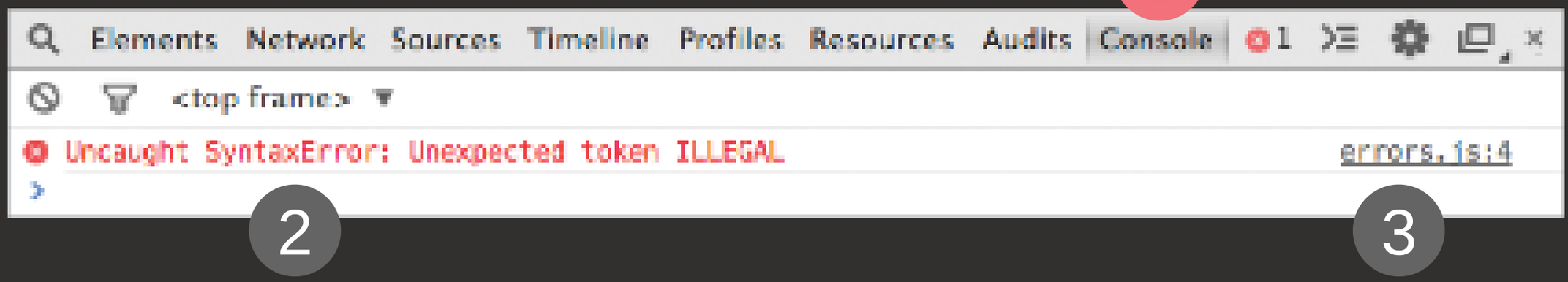
3

Values in code by setting breakpoints and comparing the values you expect to what the variables hold

THE CONSOLE & DEVELOPER TOOLS

All modern browsers have developer tools to help you debug scripts.

Start by opening the JavaScript console.

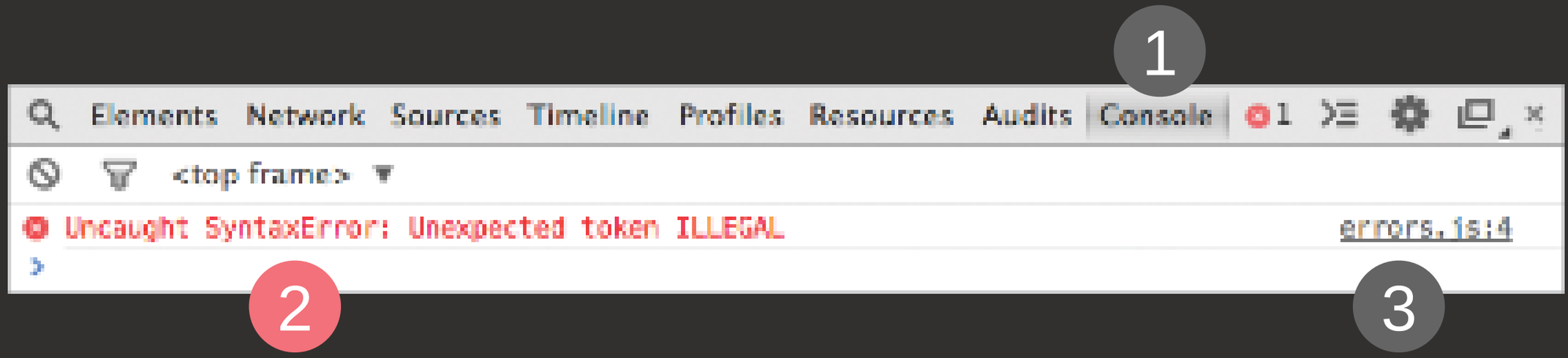


1: Console is selected

2: Type of error (`SyntaxError`)

3: File name and line number:

(`errors.js:4`)

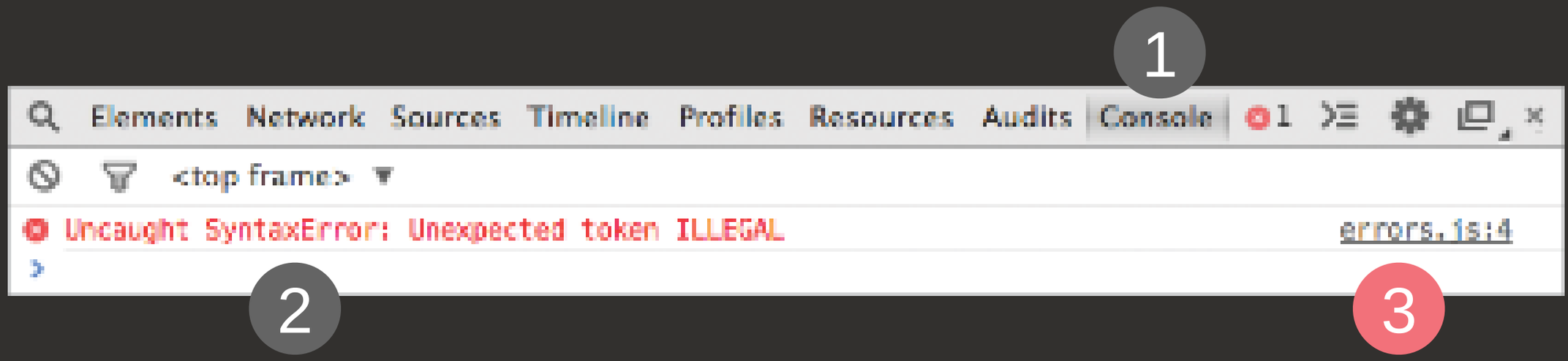


1: Console is selected

2: Type of error (`SyntaxError`)

3: File name and line number:

(`errors.js:4`)



1: Console is selected

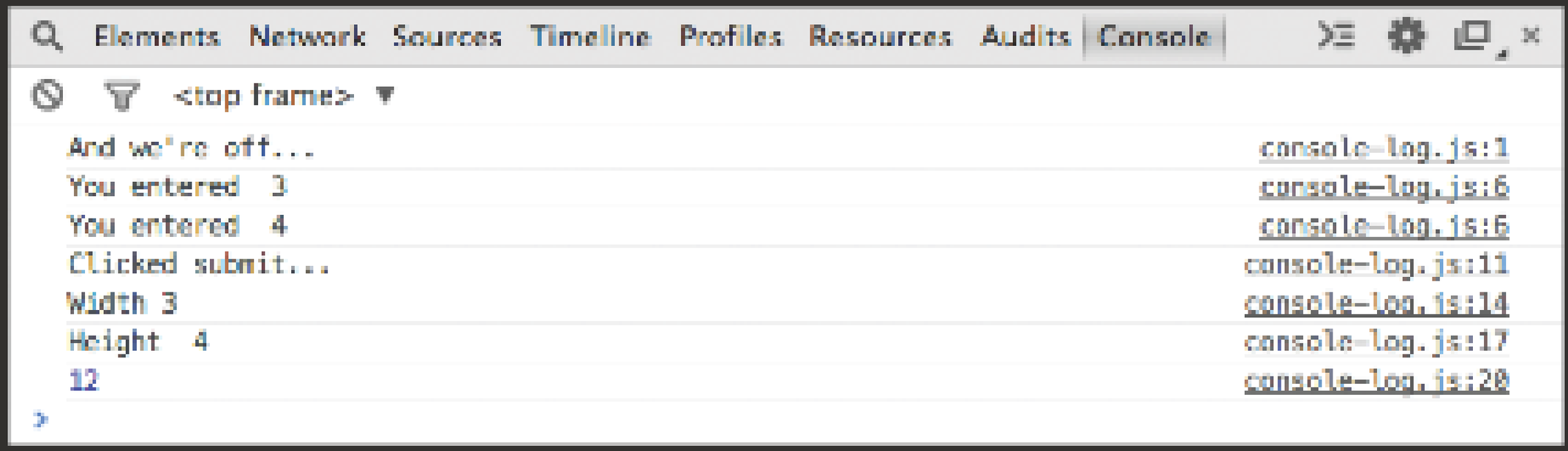
2: Type of error (`SyntaxError`)

3: File name and line number:

(`errors.js:4`)

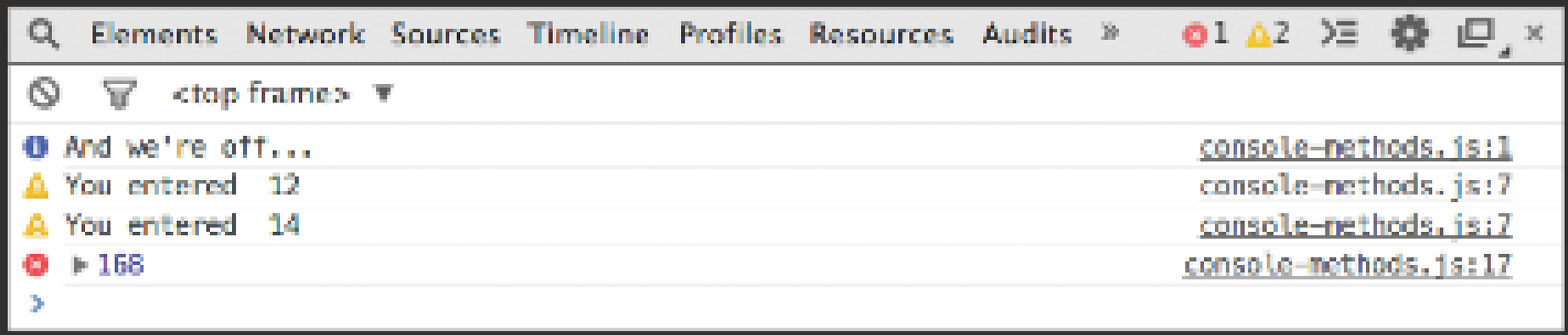
You can just type code into the console and it will show you a result.

The `console.log()` method will write code to the console as it is processed.


Elements Network Sources Timeline Profiles Resources Audits Console
<top frame>
And we're off... console-log.js:1
You entered 3 console-log.js:6
You entered 4 console-log.js:6
Clicked submit... console-log.js:11
Width 3 console-log.js:14
Height 4 console-log.js:17
12 console-log.js:20

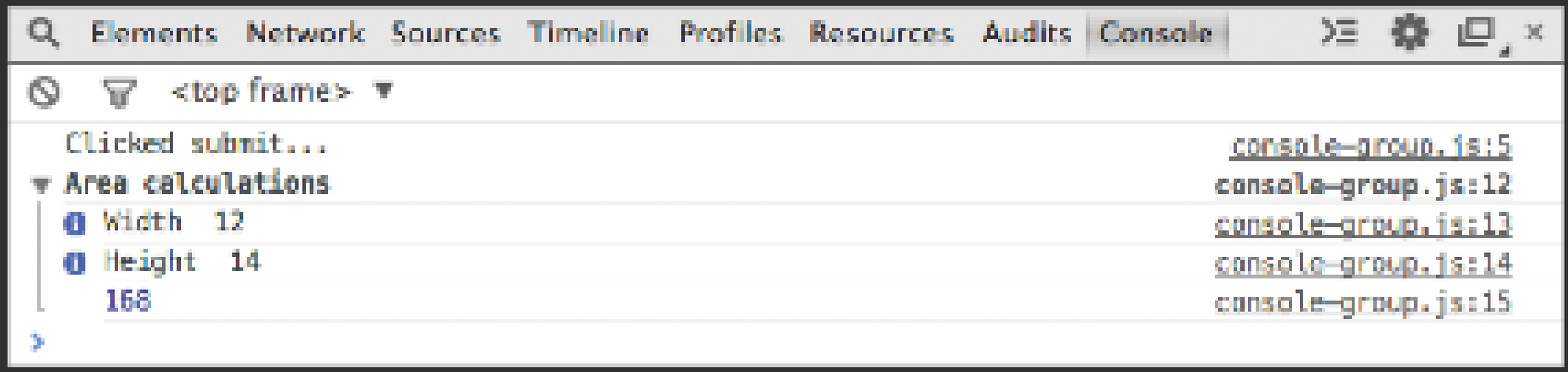
These methods show messages like `log()` but have a slightly different style:

```
console.info()
console.warn()
console.error()
```


Elements Network Sources Timeline Profiles Resources Audits
1 2
<top frame>
And we're off...
console-methods.js:1
You entered 12
console-methods.js:7
You entered 14
console-methods.js:7
168
console-methods.js:17

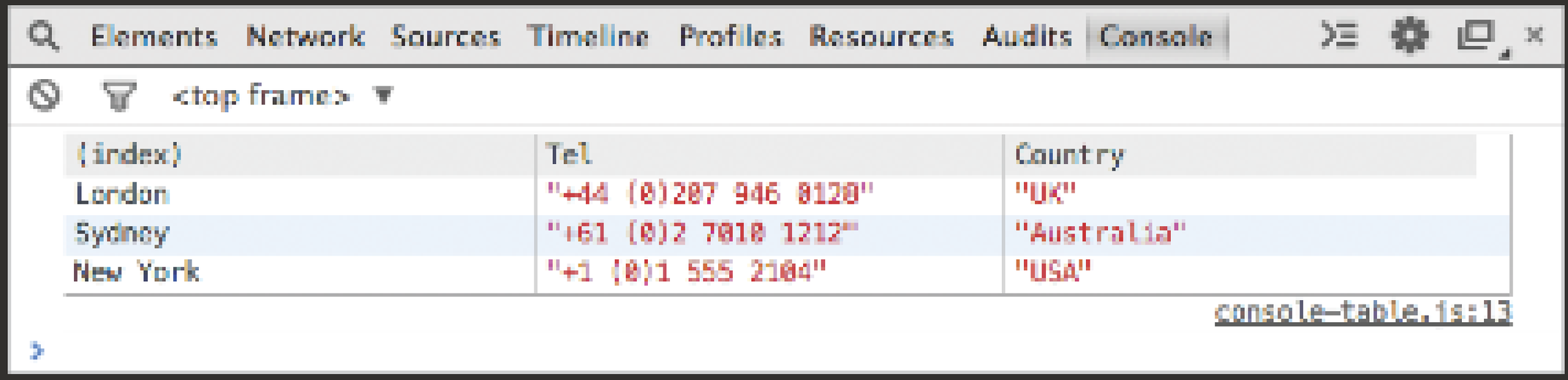
You can group error messages with:

```
console.group(‘Areas’);
  console.info(‘Width ‘, width);
  console.info(‘Height ‘, height);
  console.log(area);
console.groupEnd();
```


Elements Network Sources Timeline Profiles Resources Audits Console
<top frame>
Clicked submit...
console-group.js:5
Area calculations
console-group.js:12
Width 12
console-group.js:13
Height 14
console-group.js:14
168
console-group.js:15

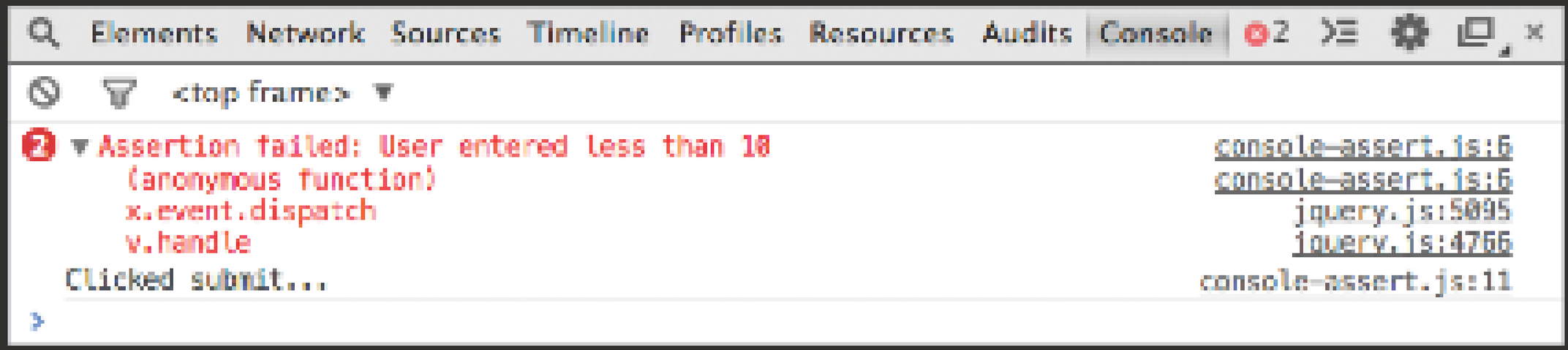
You can write arrays and object data into a table with:

```
console.table(objectname);
```

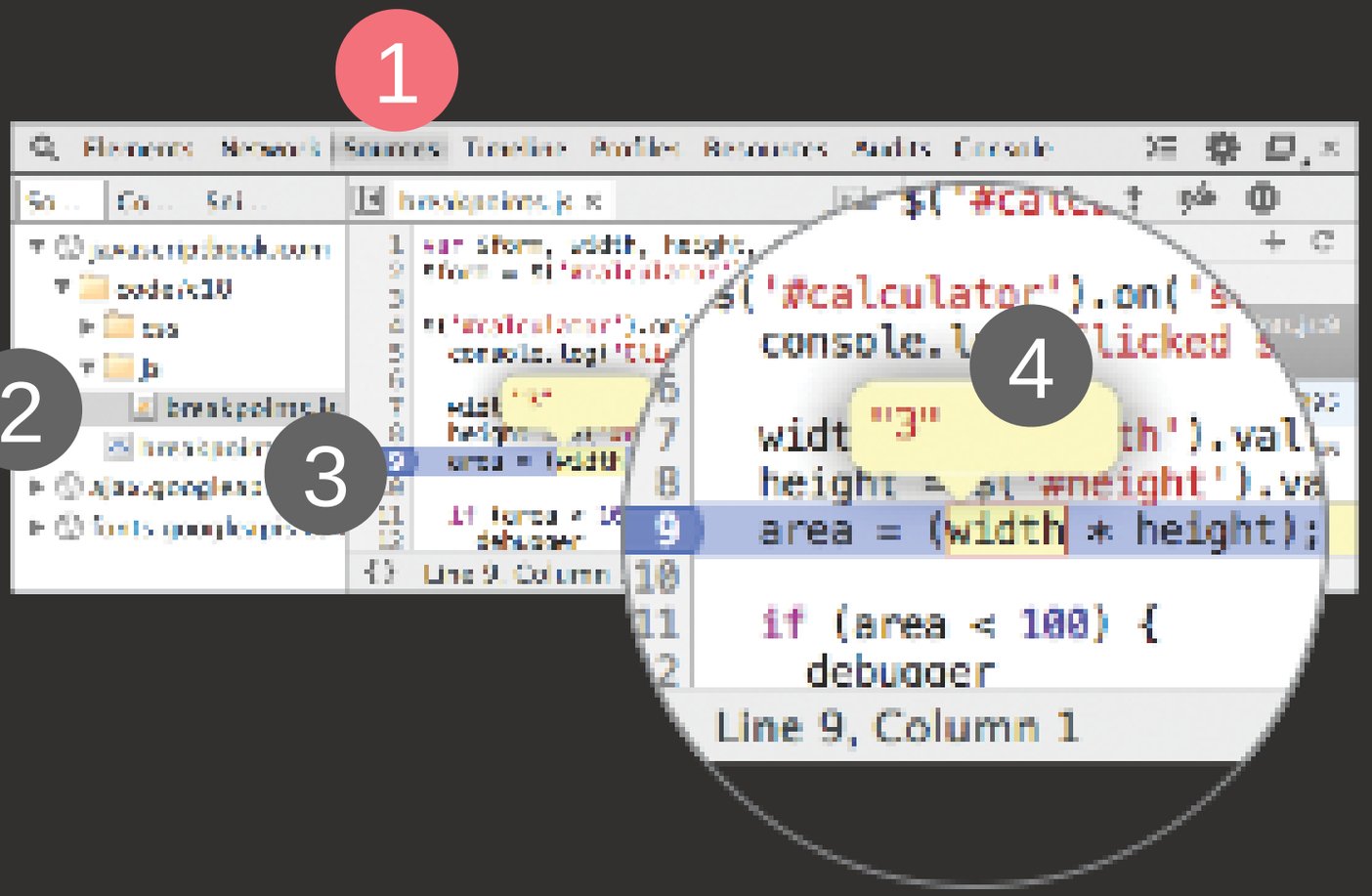

Elements Network Sources Timeline Profiles Resources Audits Console
<top frame>
(index) Tel Country
London "+44 (0)207 946 8120" "UK"
Sydney "+61 (0)2 7010 1212" "Australia"
New York "+1 (0)1 555 2104" "USA"
console-table.js:13

You can write on a condition with:

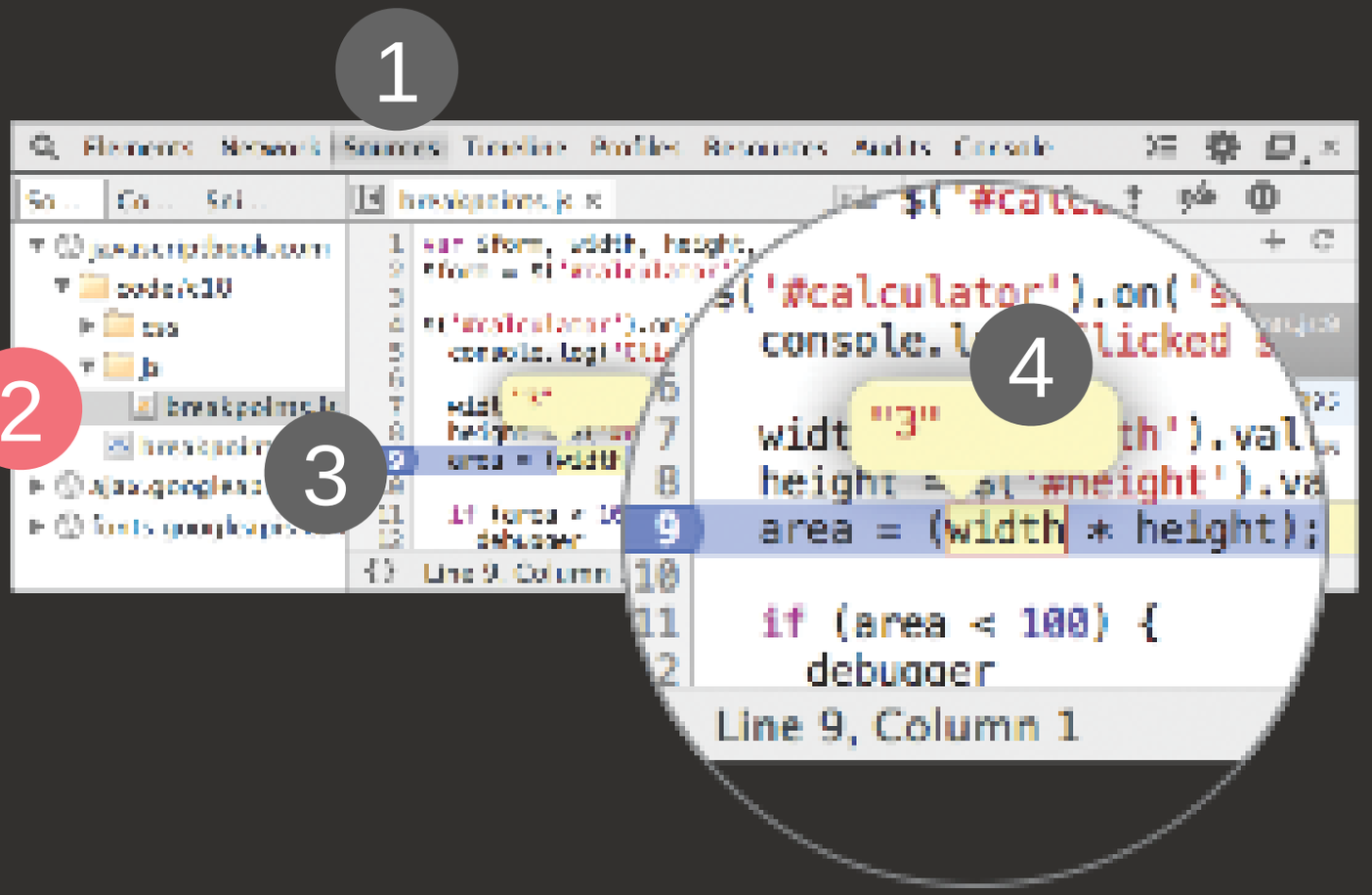
```
console.assert(this.value > 10,
               'User entered less than 10');
```


Elements Network Sources Timeline Profiles Resources Audits Console
2
<top frame>
Assertion failed: User entered less than 10
(anonymous function)
x.event.dispatch
v.handle
Clicked submit...
console-assert.js:6
console-assert.js:6
jquery.js:5095
jquery.js:4766
console-assert.js:11

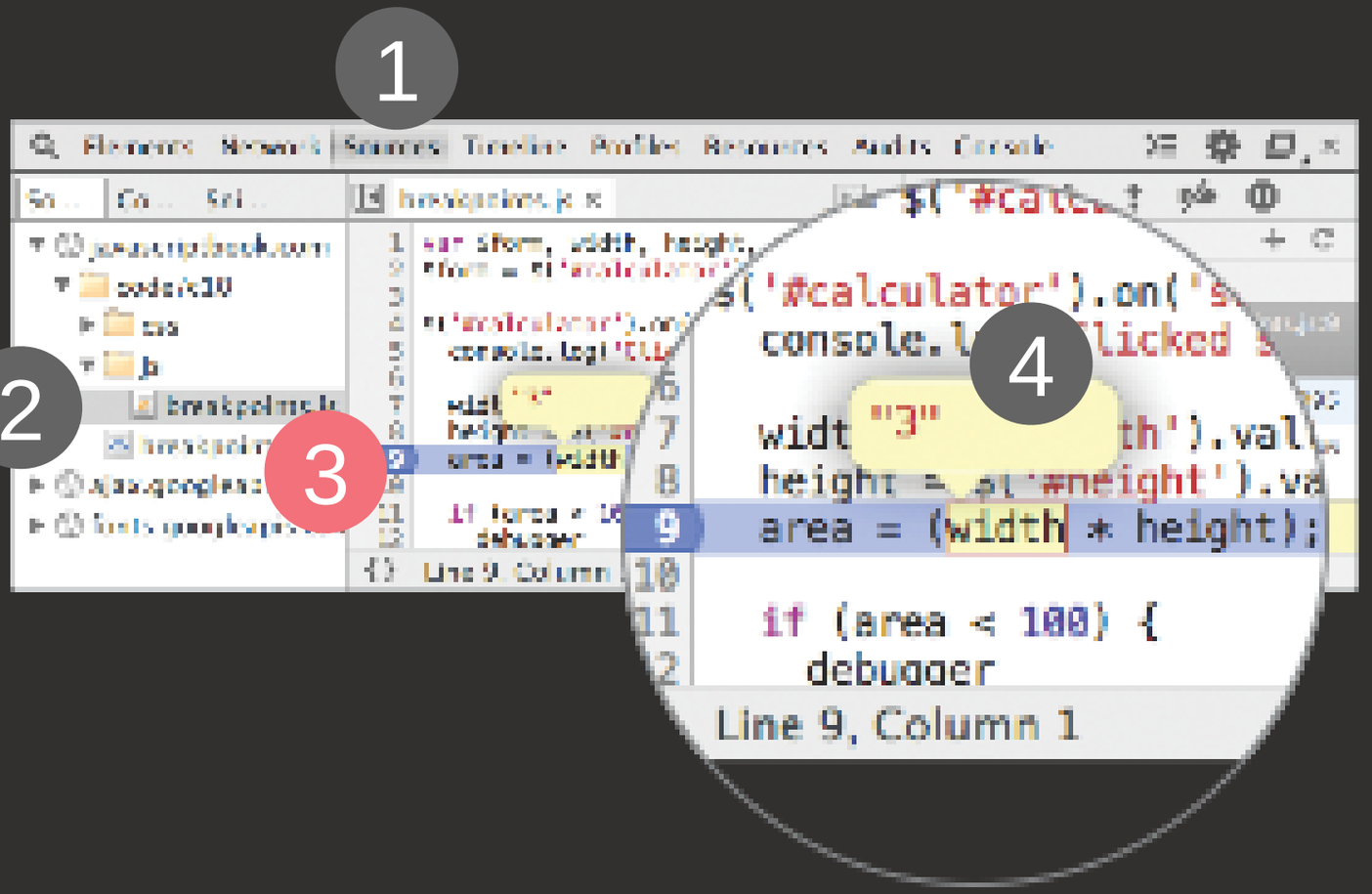
Breakpoints let you pause the script on any line, allowing you to then check the values stored in variables.



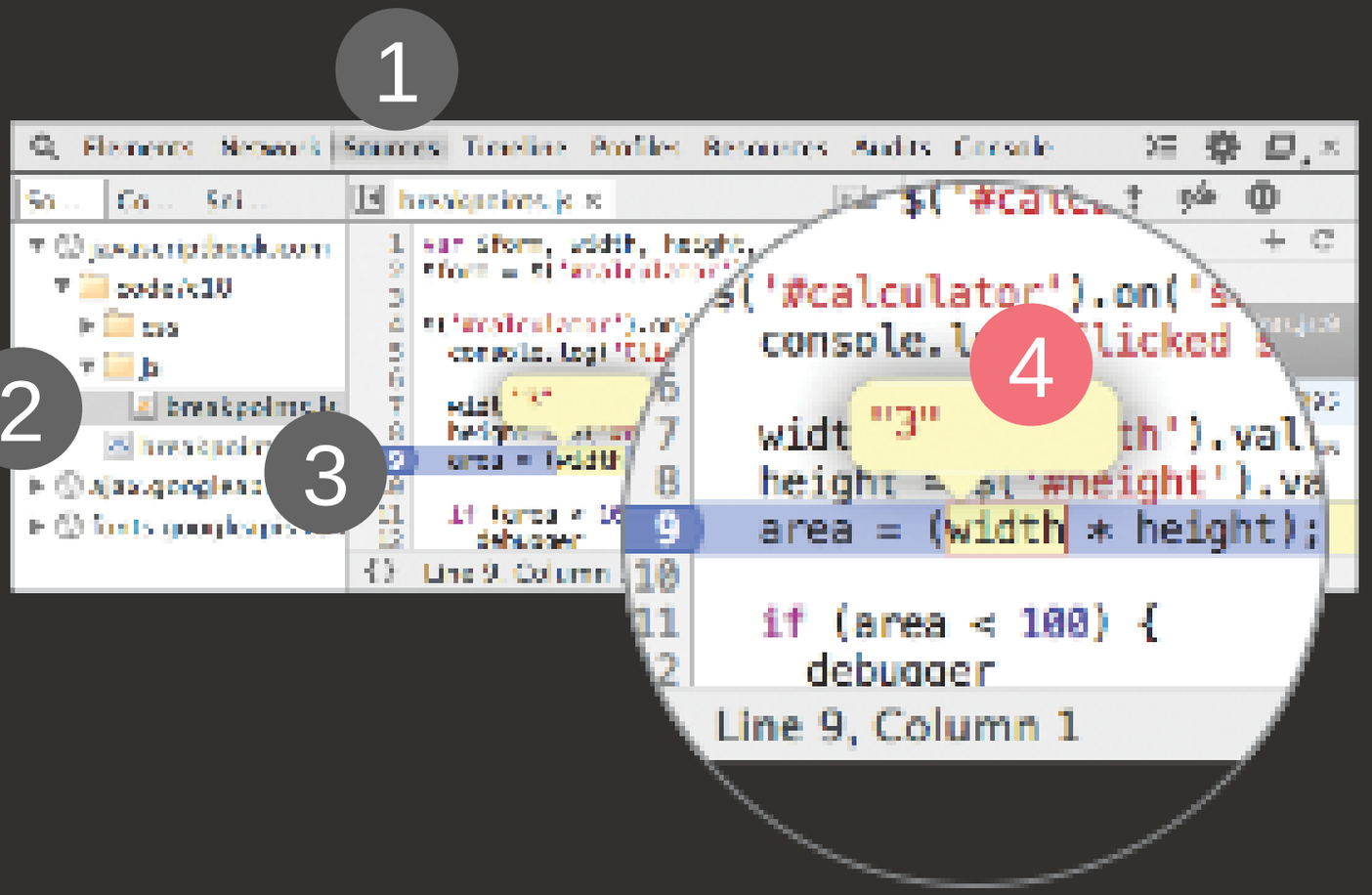
1: Sources is selected



2: Script is chosen



3: Line number is clicked on



4: Variable is hovered over

If you have several breakpoints, you can step through them one by one.

1 2 3 4

1: Pause button turns into a play button when a breakpoint is encountered

1 2 3 4

2: Go to next line of code and step through the lines one-by-one

1 2 3 4

3: Step into a function call

1 2 3 4

4: Step out of a function that you stepped into

You can create a breakpoint with the `debugger` keyword:

```
if (area < 100) {
   debugger;
}
```

HANDLING EXCEPTIONS

If you know your code could fail, you can use `try`, `catch`, and `finally`.

Each gets its own code block.

```
try {
 // Try to run this code
} catch (exception) {
 // If an exception occurs, run this code
} finally {
 // Always gets executed
}
```

```
try {
 // Try to run this code
} catch (exception) {
 // If an exception occurs, run this code
} finally {
 // Always gets executed
}
```

```
try {
 // Try to run this code
} catch (exception) {
 // If an exception occurs, run this code
} finally {
 // Always gets executed
}
```

```
try {
 // Try to run this code
} catch (exception) {
 // If an exception occurs, run this code
} finally {
 // Always gets executed
}
```