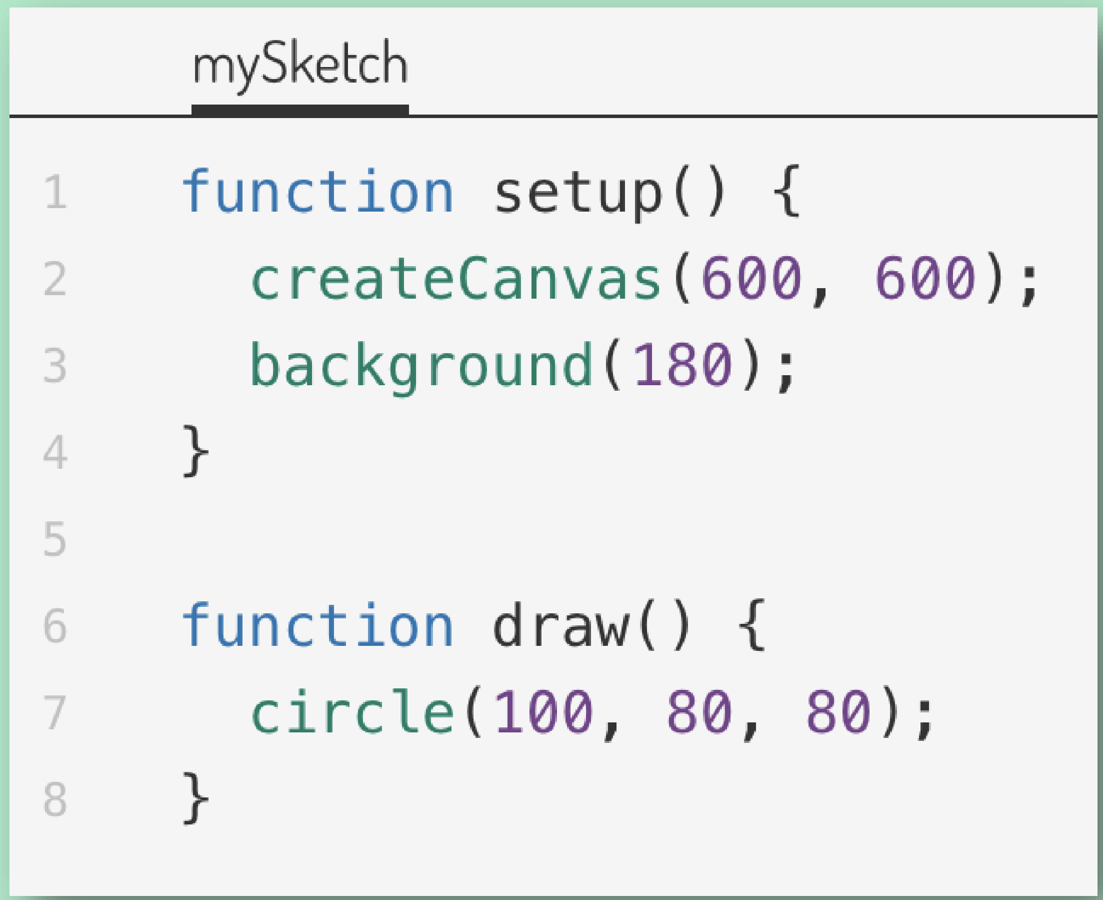
Luxembourg Tech School

LEVEL GO
2025-2026

3 – Movement with p5.js

Recap Quiz

1. What does this code do?

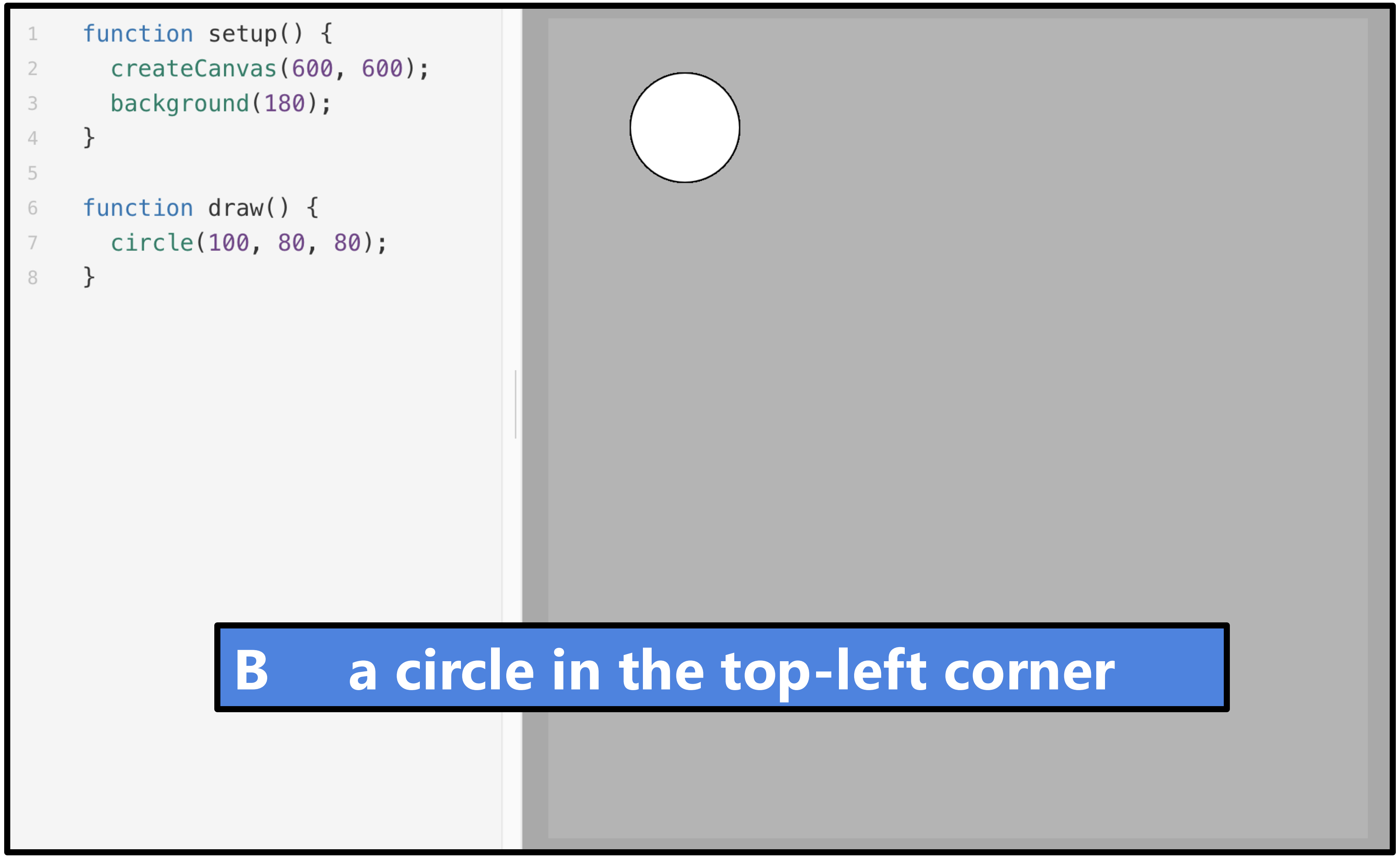


mySketch

```
function setup() {
  createCanvas(600, 600);
  background(180);
}

function draw() {
  circle(100, 80, 80);
}
```

- (A) a black rectangle
- (B) a circle in the top-left corner
- (C) a circle in the middle of the canvas
- (D) nothing; there is something missing in the code

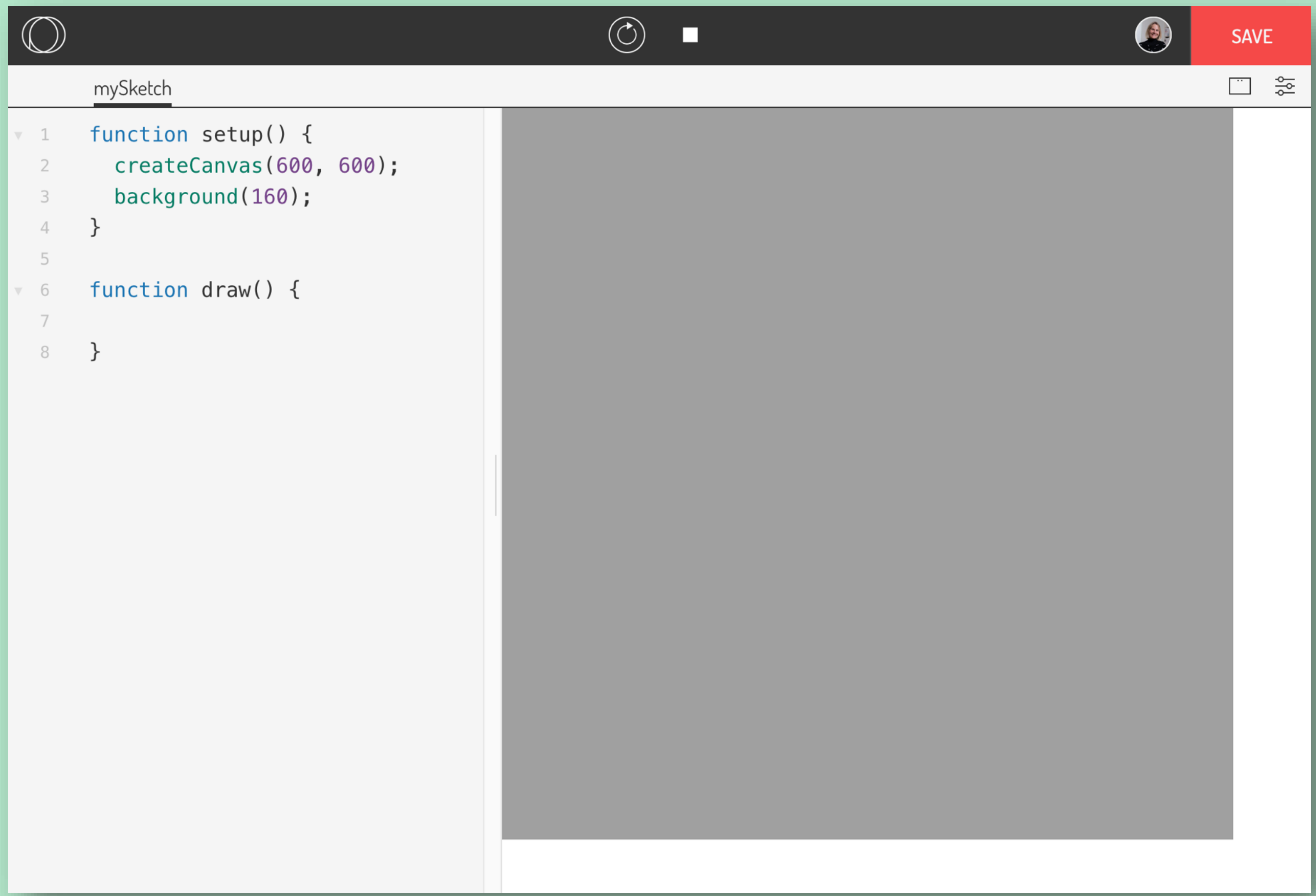
1. What does this code do?



```
function setup() {
  createCanvas(600, 600);
  background(180);
}

function draw() {
  circle(100, 80, 80);
}
```

B a circle in the top-left corner

2. Where is (0, 0) on the canvas?



```
function setup() {
  createCanvas(600, 600);
  background(160);
}

function draw() {

}
```

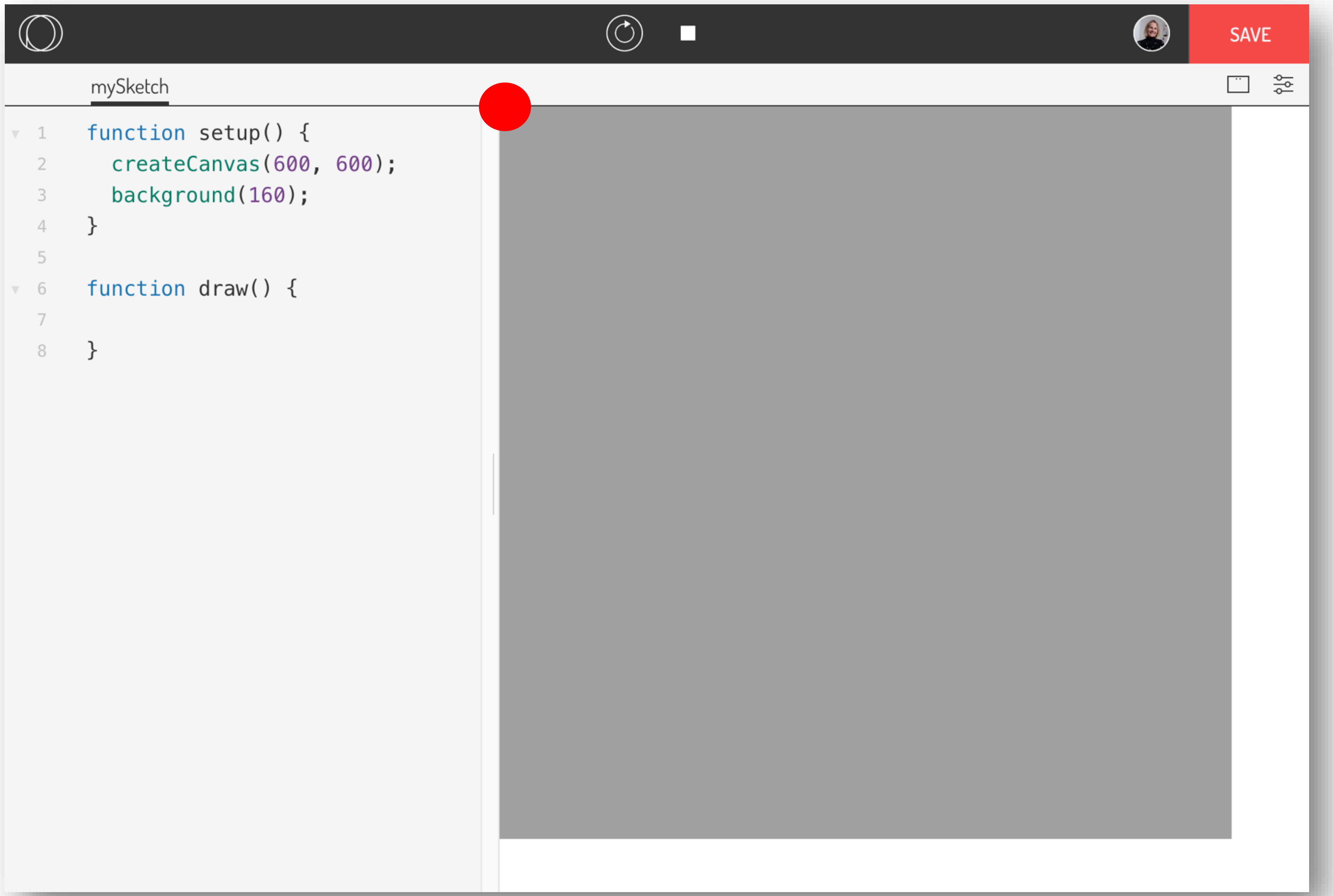
A bottom right

B top left

C center

D random position

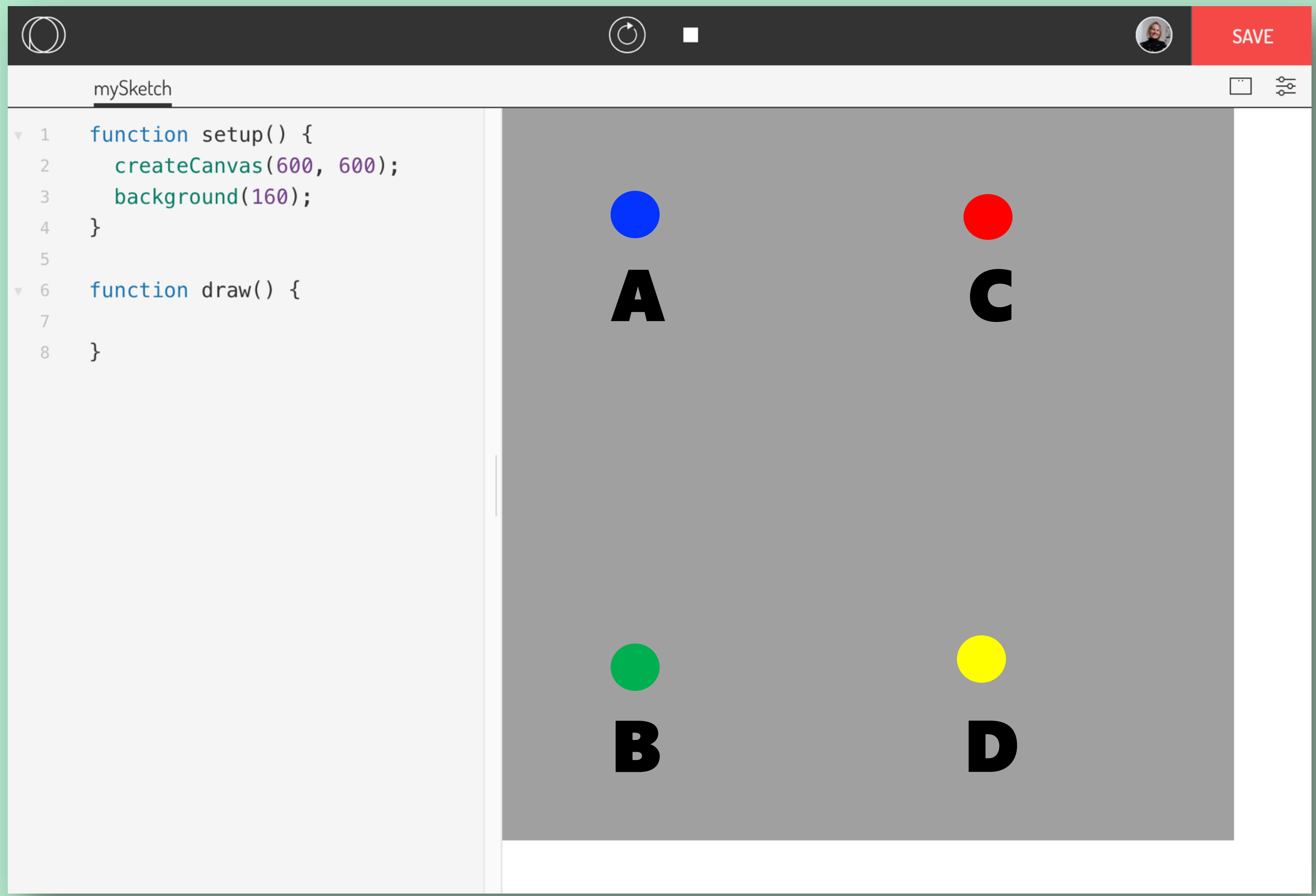
2. Where is (0, 0) on the canvas?



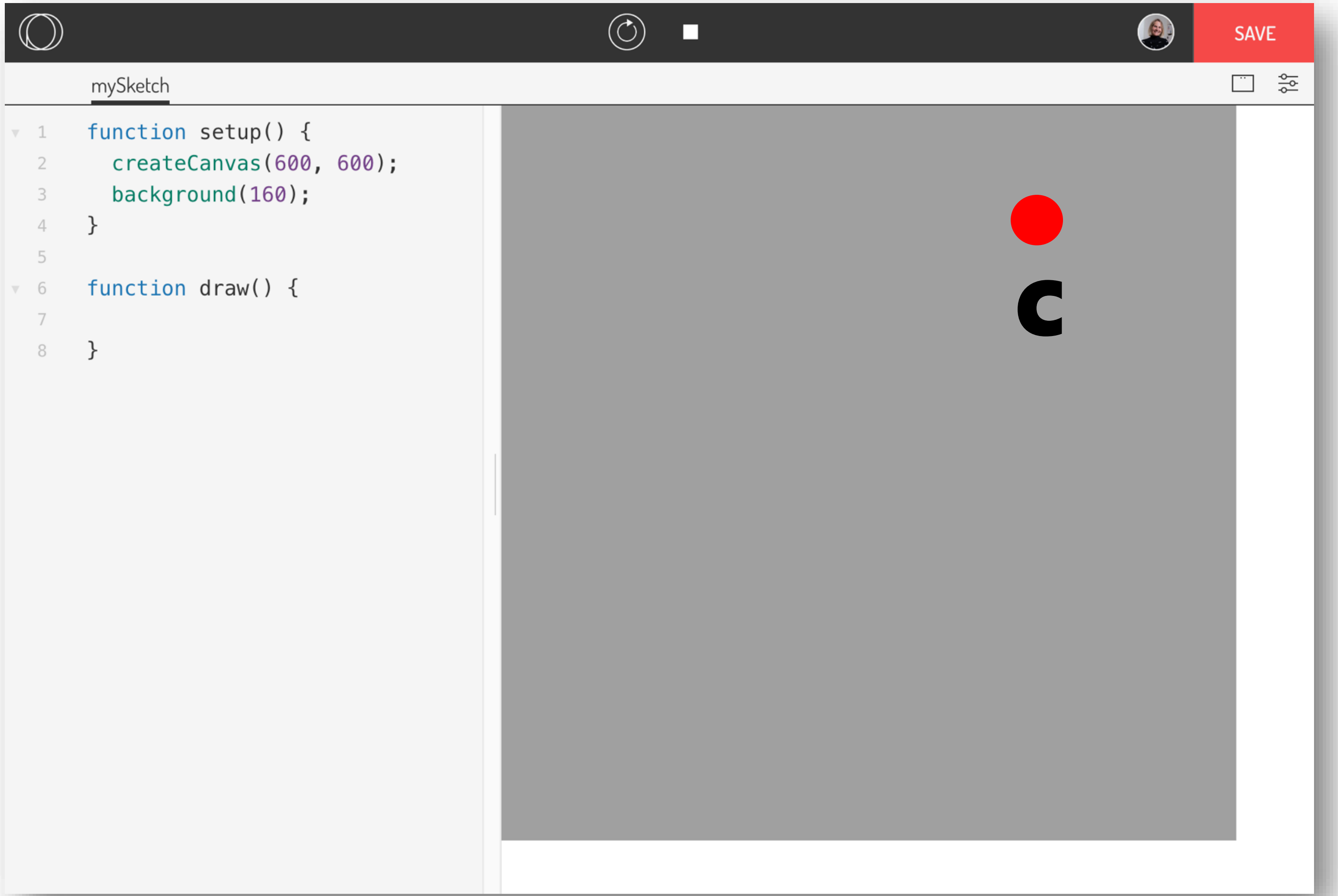
```
function setup() {
  createCanvas(600, 600);
  background(160);
}

function draw() {

}
```

- Ⓐ bottom right
- [✓ Ⓑ top left]
- Ⓒ center
- Ⓓ random position

3. Where is (400, 100) on the canvas?

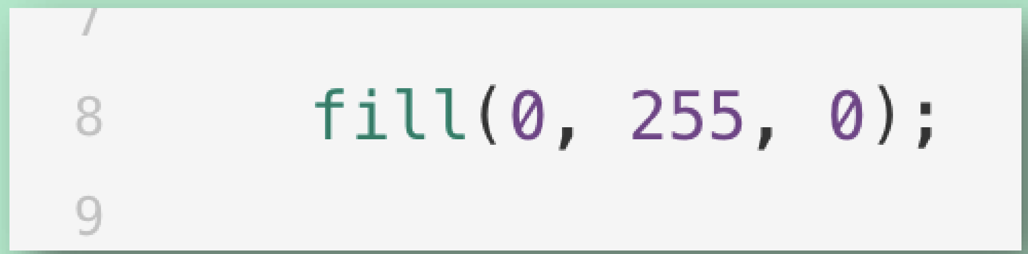

```
function setup() {
  createCanvas(600, 600);
  background(160);
}

function draw() {

}
```

2. Where is (400, 100) on the canvas?



```
function setup() {
  createCanvas(600, 600);
  background(160);
}

function draw() {

}
```

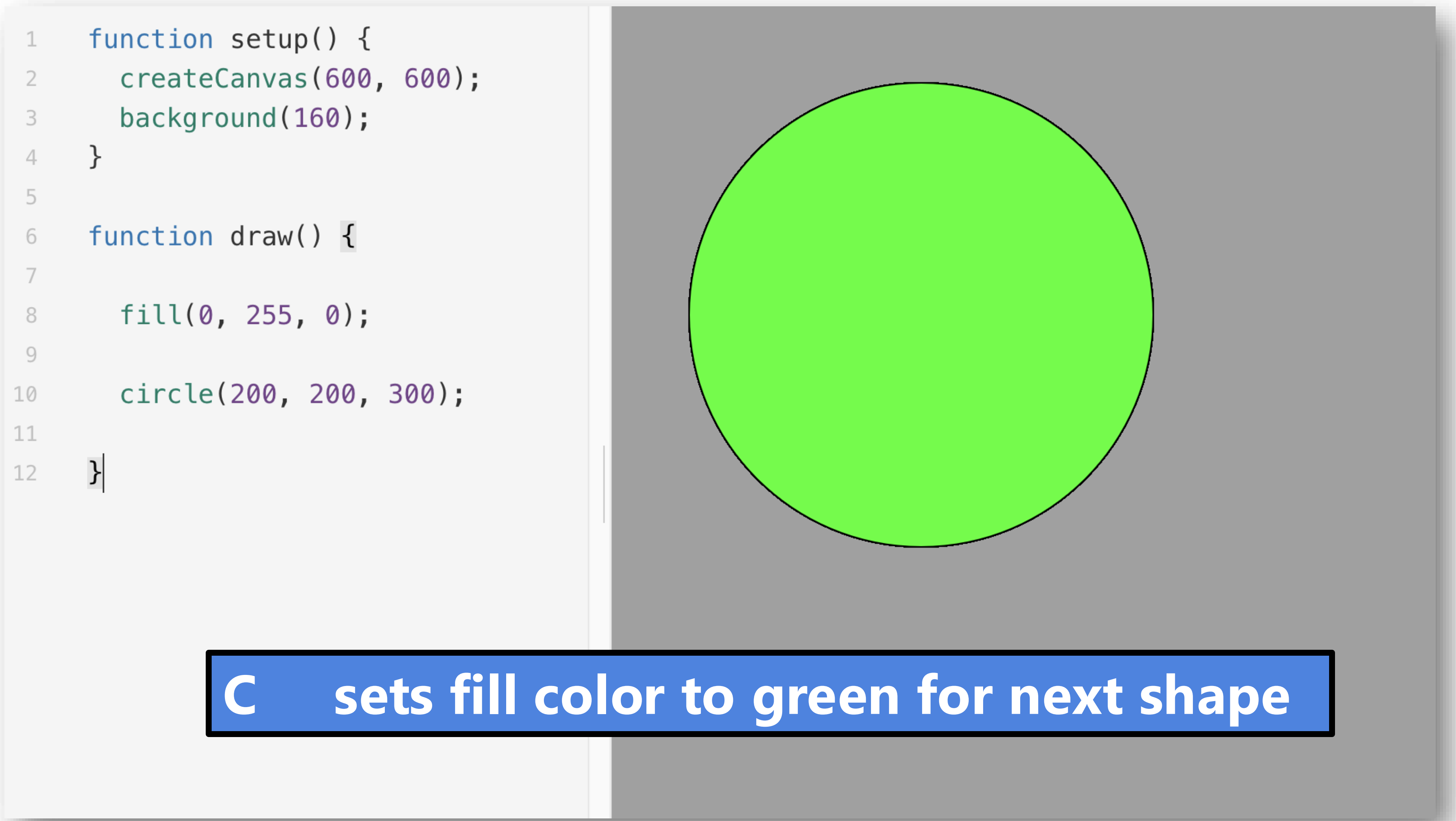
4. What does this line of code do?



```
    fill(0, 255, 0);
```

- (A) sets background color to green
- (B) paints canvas red
- (C) sets fill color to green for next shape
- (D) deletes all shapes

4. What does this line of code do?

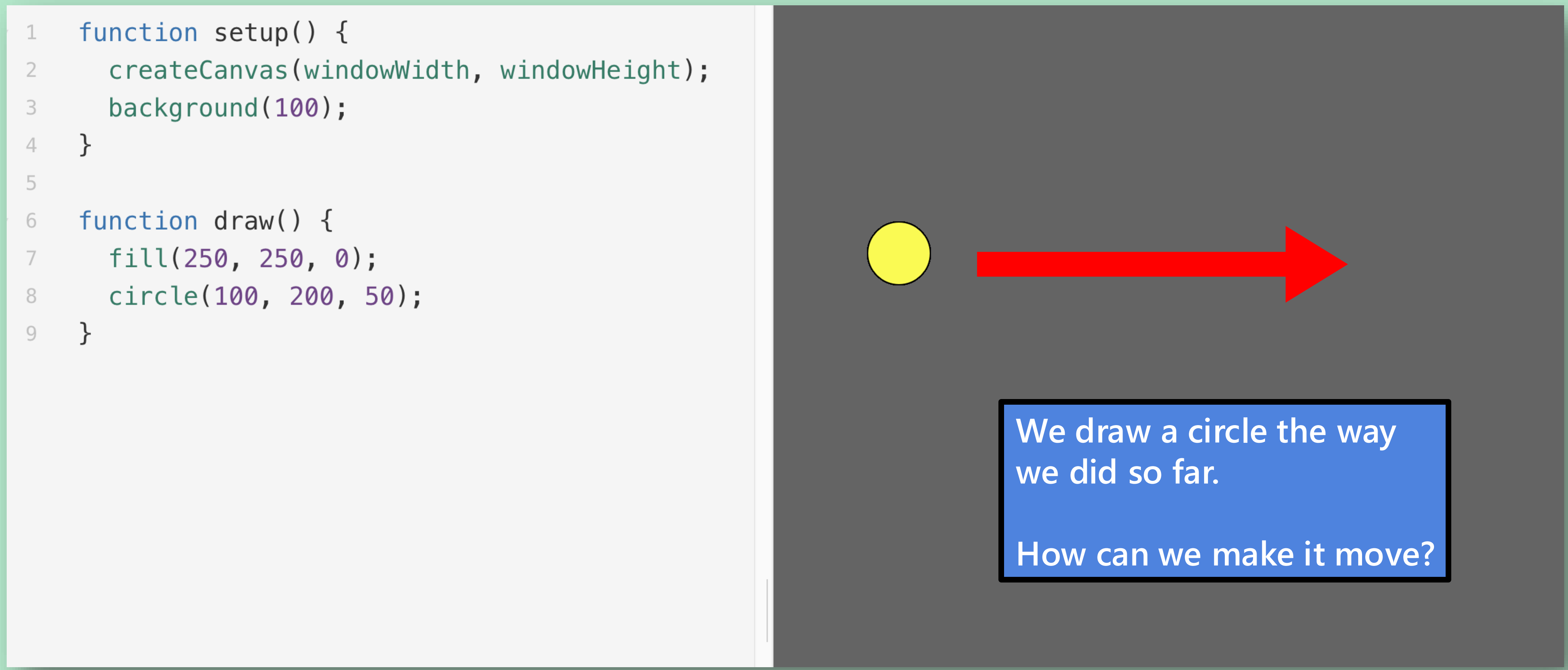


```
function setup() {
  createCanvas(600, 600);
  background(160);
}

function draw() {

  fill(0, 255, 0);

  circle(200, 200, 300);

}
```

C sets fill color to green for next shape

Let‘s start with some new things…

What if we want this circle to move?

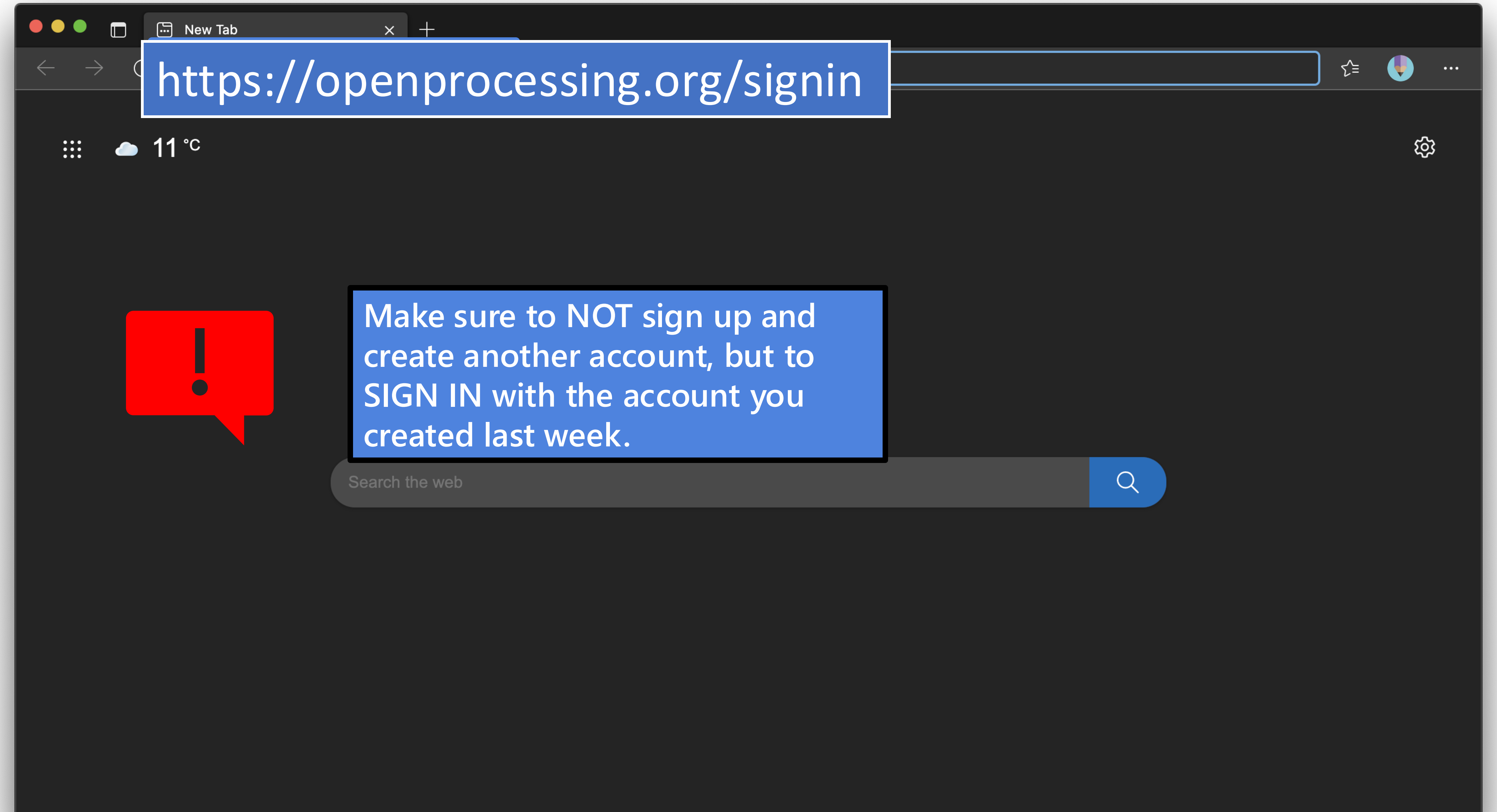


```
function setup() {
  createCanvas(windowWidth, windowHeight);
  background(100);
}

function draw() {
  fill(250, 250, 0);
  circle(100, 200, 50);
}
```

We draw a circle the way we did so far.

How can we make it move?

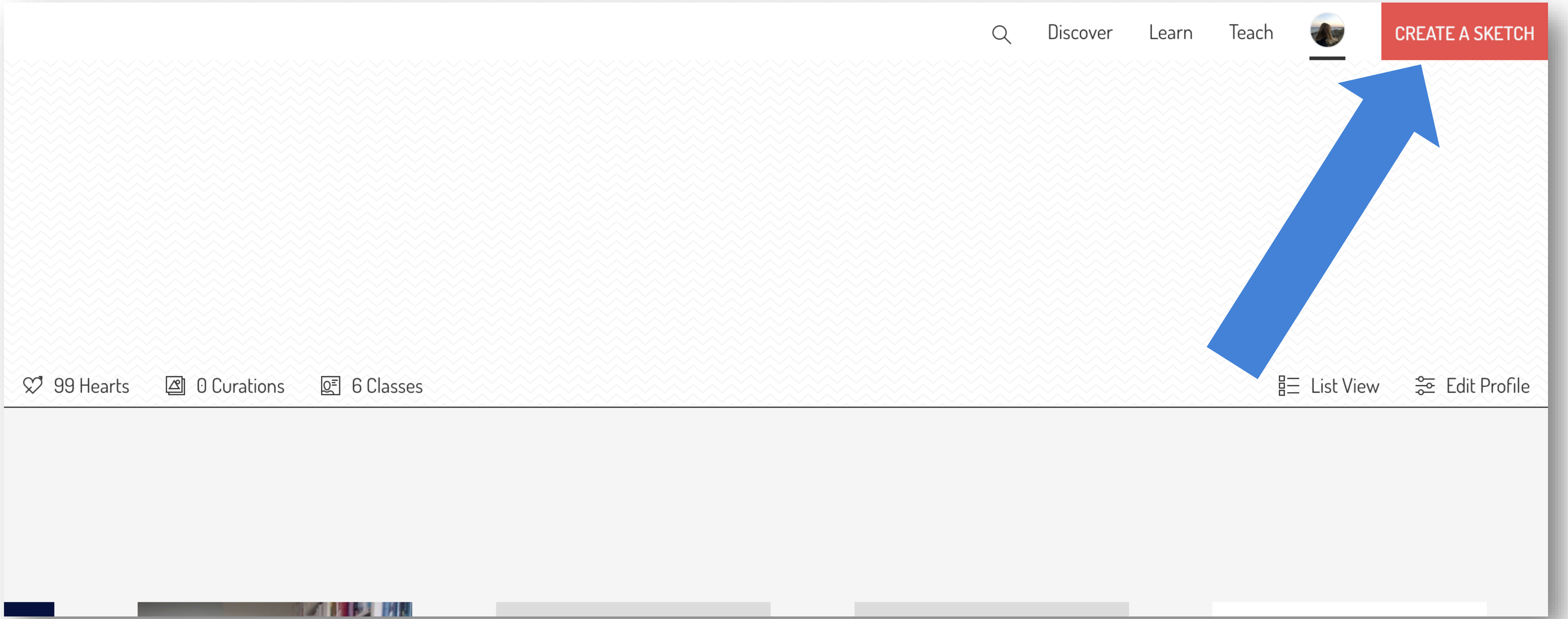
Open OpenProcessing in your browser



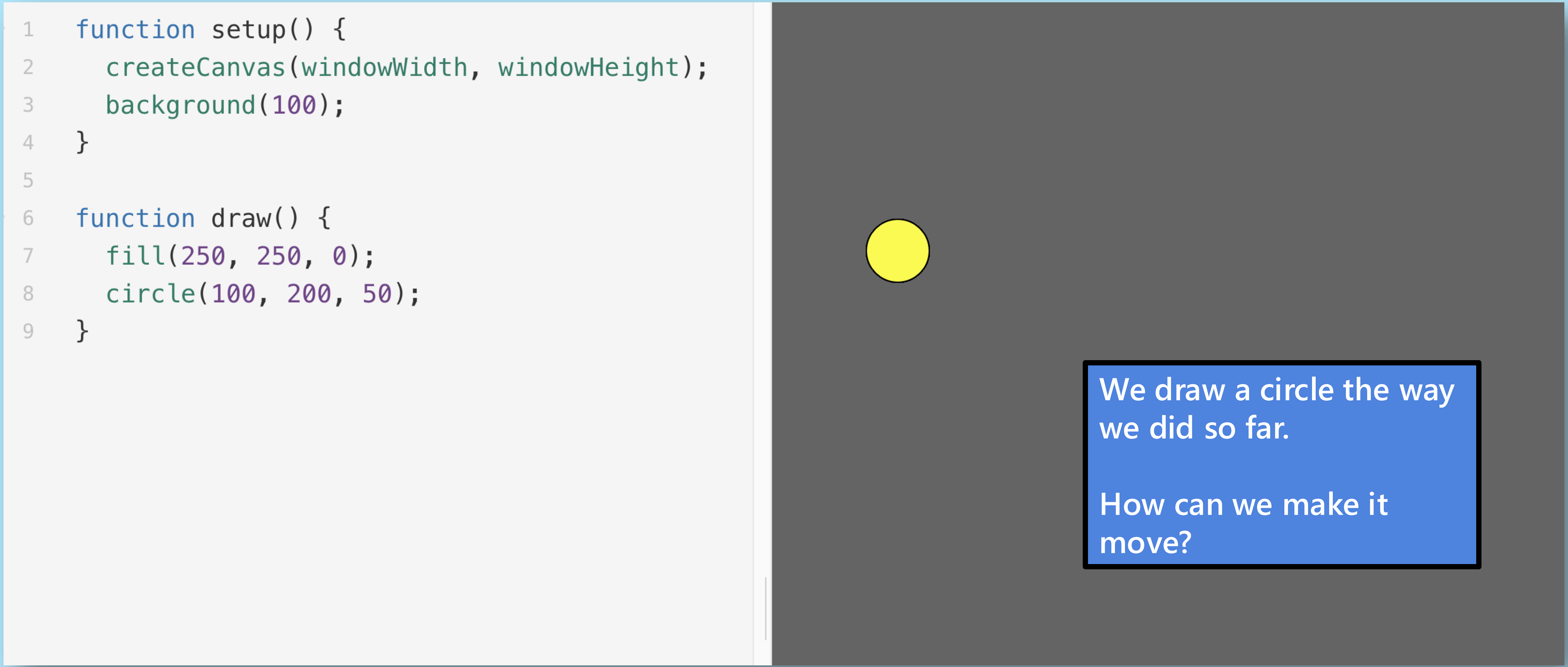
https://openprocessing.org/signin

Make sure to NOT sign up and create another account, but to SIGN IN with the account you created last week.

Create a new sketch



What if we want this circle to move?

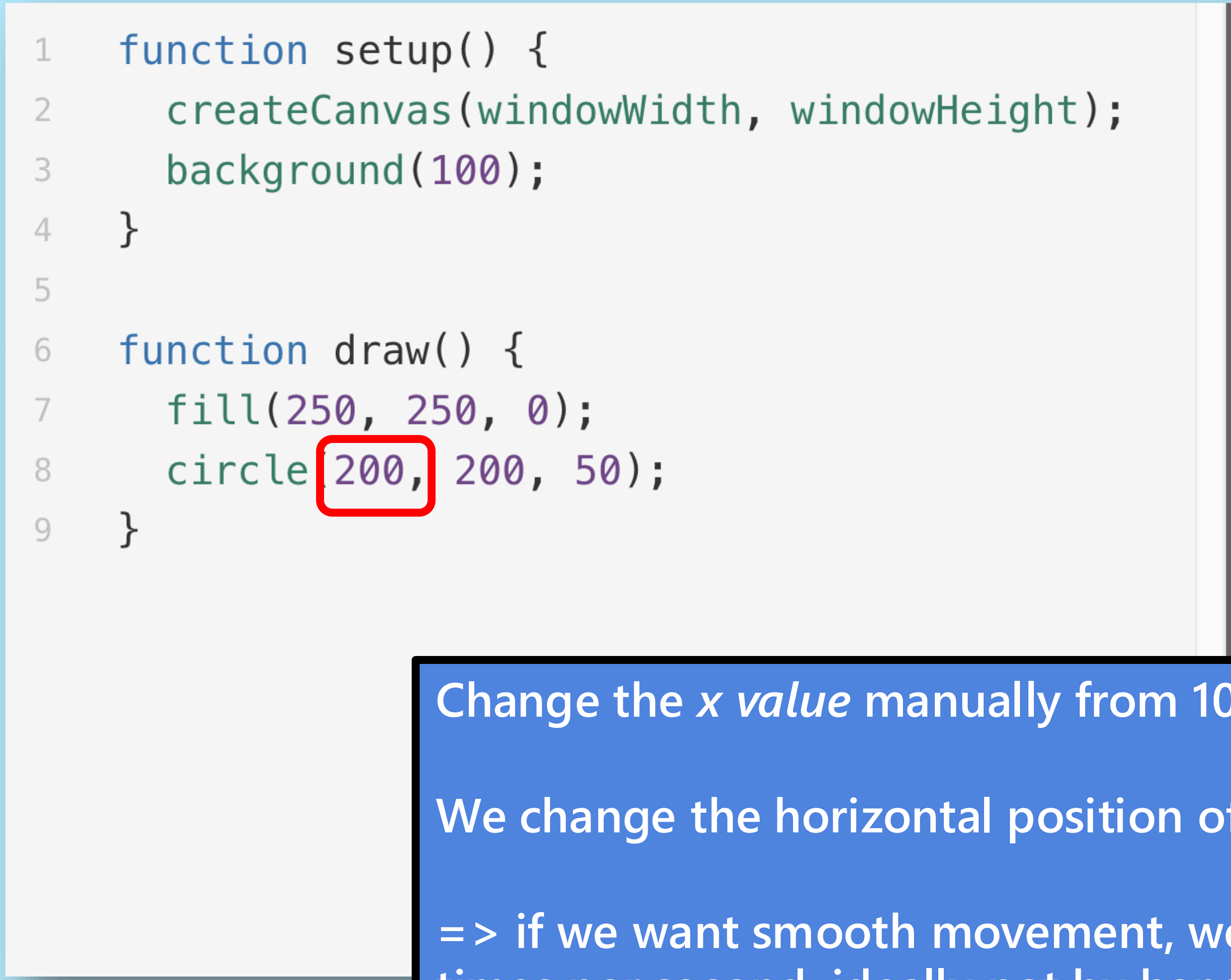


```
function setup() {
  createCanvas(windowWidth, windowHeight);
  background(100);
}

function draw() {
  fill(250, 250, 0);
  circle(100, 200, 50);
}
```

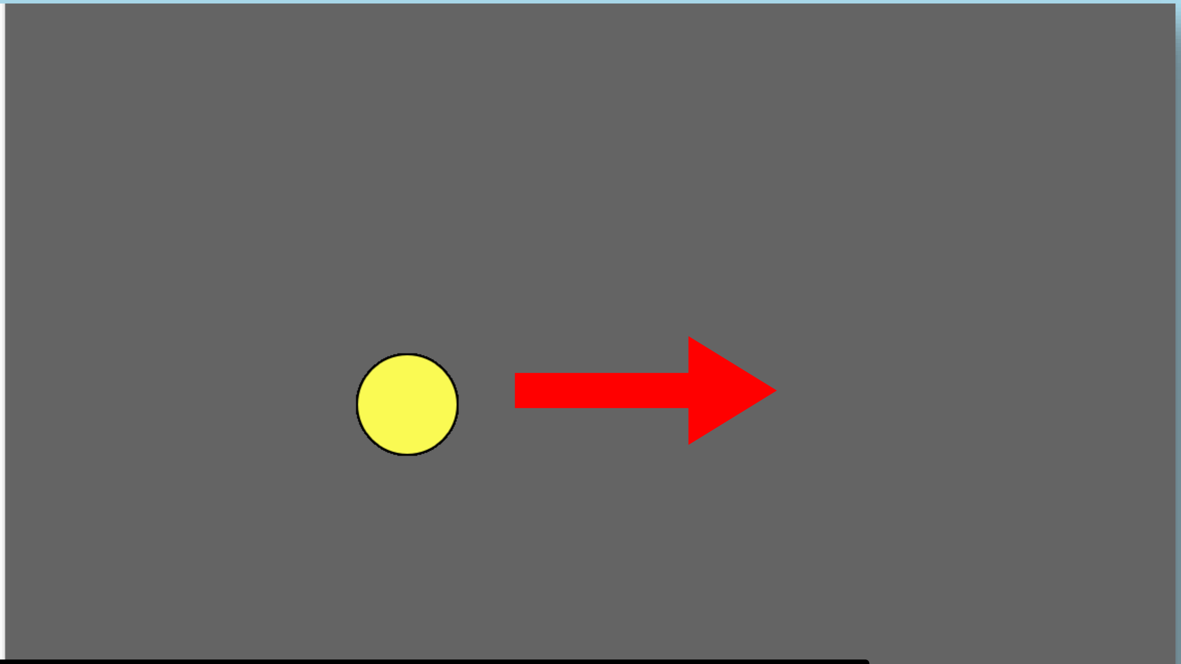
We draw a circle the way we did so far.

How can we make it move?

What if we want this circle to move?



```
function setup() {
  createCanvas(windowWidth, windowHeight);
  background(100);
}

function draw() {
  fill(250, 250, 0);
  circle(200, 200, 50);
}
```

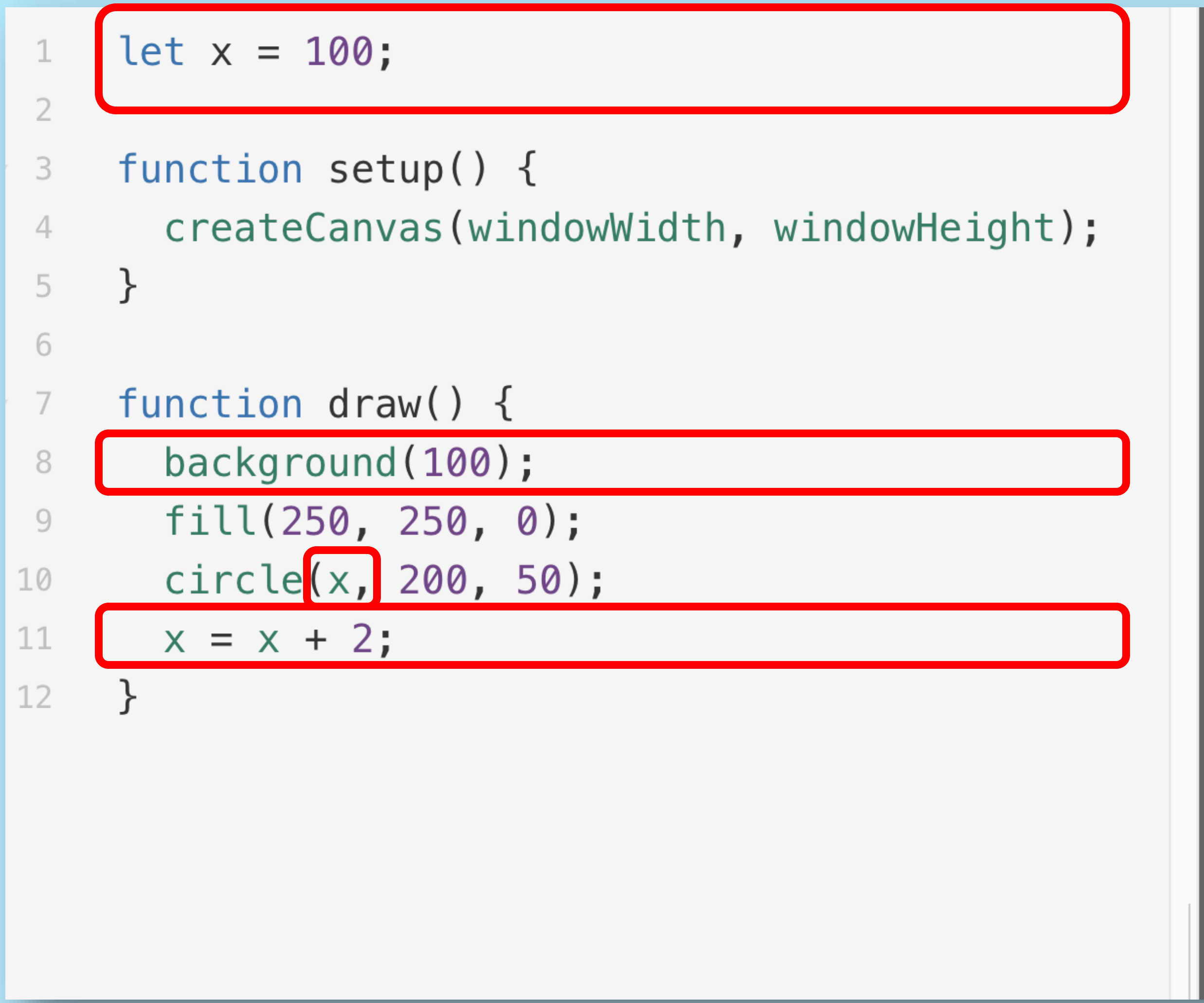


Change the *x value* manually from 100 to 200 to 300.

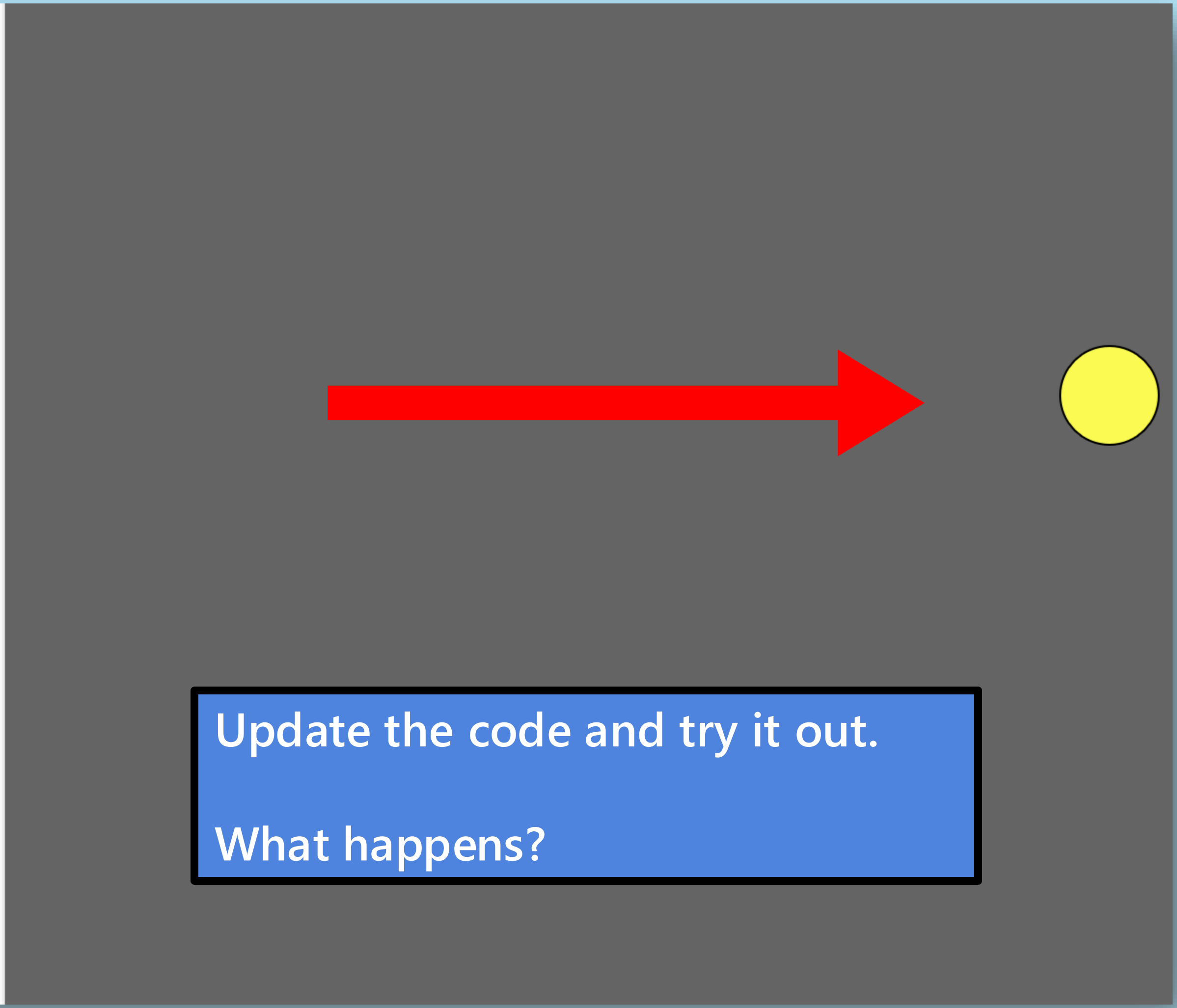
We change the horizontal position of the circle, but it is still static.

=> if we want smooth movement, we need to update the position many times per second, ideally not by hand….

Let‘s update our code to add movement



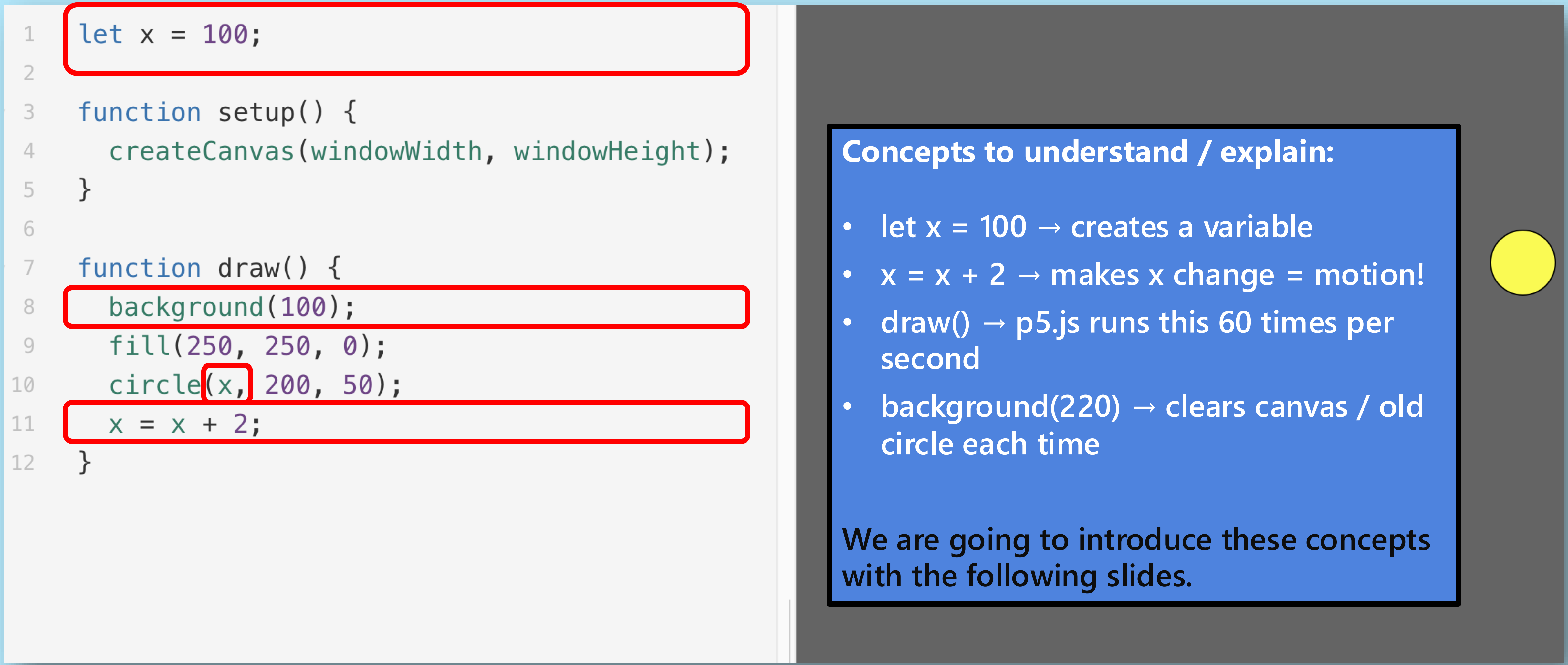
```
let x = 100;

function setup() {
  createCanvas(windowWidth, windowHeight);
}

function draw() {
  background(100);
  fill(250, 250, 0);
  circle(x, 200, 50);
  x = x + 2;
}
```



Update the code and try it out.

What happens?

Let's break it down…



```
let x = 100;

function setup() {
  createCanvas(windowWidth, windowHeight);
}

function draw() {
  background(100);
  fill(250, 250, 0);
  circle(x, 200, 50);
  x = x + 2;
}
```

Concepts to understand / explain:

- let x = 100 → creates a variable
- x = x + 2 → makes x change = motion!
- draw() → p5.js runs this 60 times per second
- background(220) → clears canvas / old circle each time

We are going to introduce these concepts with the following slides.

Variables & draw()

Introducing Variables

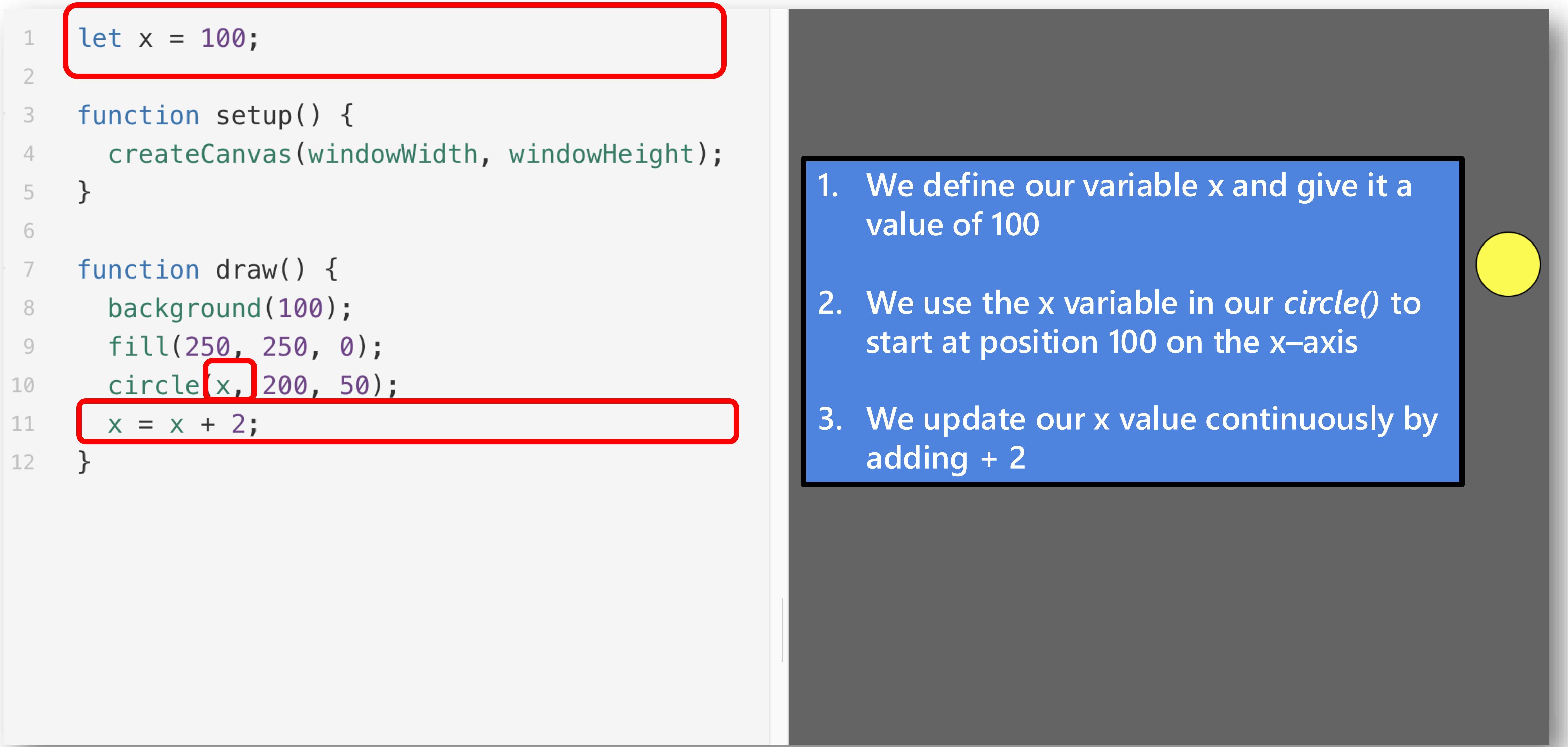
variable

value

Variables are like boxes that we can put values in.

We give the variable a name.

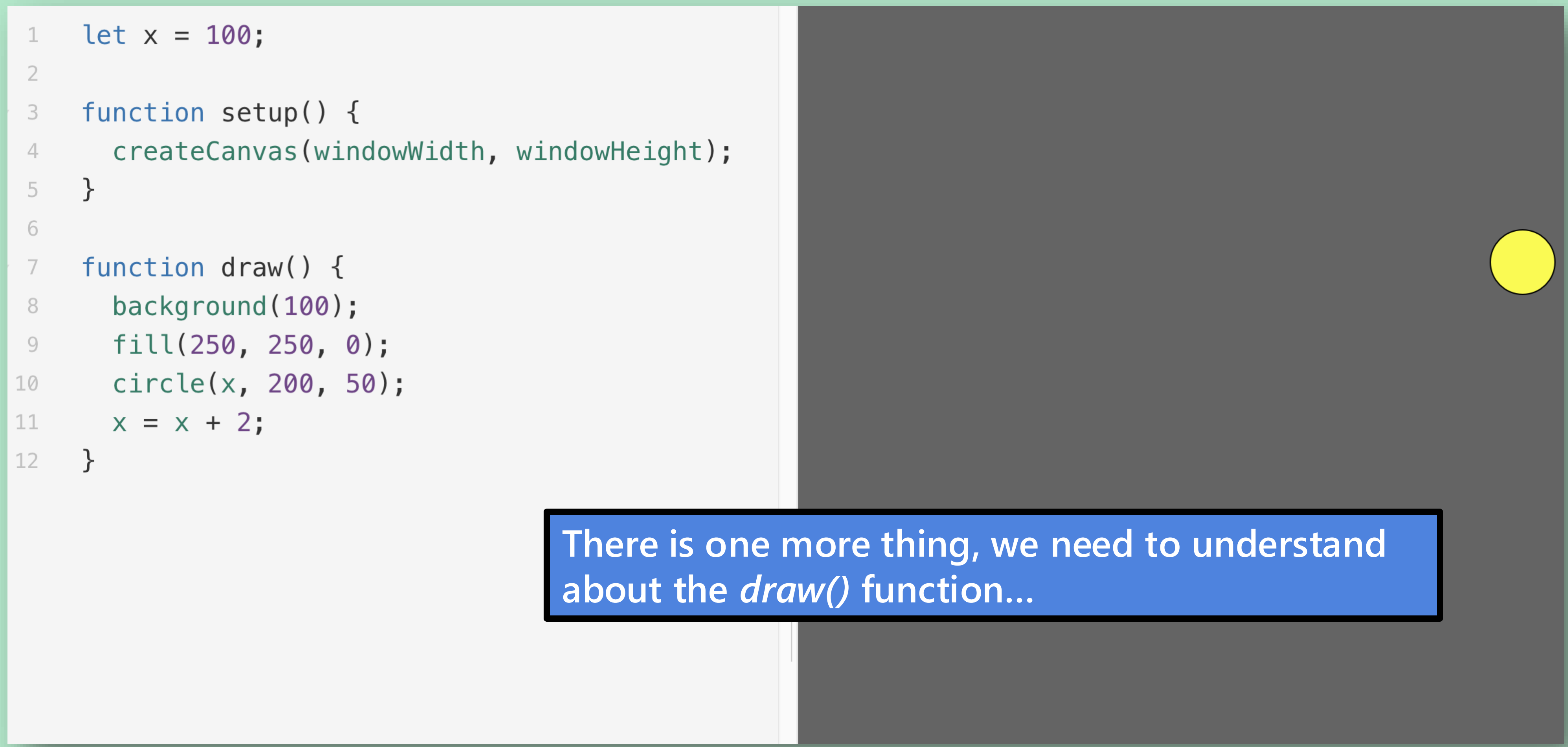
Variables to change position



```
let x = 100;

function setup() {
  createCanvas(windowWidth, windowHeight);
}

function draw() {
  background(100);
  fill(250, 250, 0);
  circle(x, 200, 50);
  x = x + 2;
}
```

1. We define our variable x and give it a value of 100
2. We use the x variable in our *circle()* to start at position 100 on the x–axis
3. We update our x value continuously by adding + 2

But why exactly does it move?



```
let x = 100;

function setup() {
  createCanvas(windowWidth, windowHeight);
}

function draw() {
  background(100);
  fill(250, 250, 0);
  circle(x, 200, 50);
  x = x + 2;
}
```

There is one more thing, we need to understand about the *draw()* function…

Introducing the magic of draw()

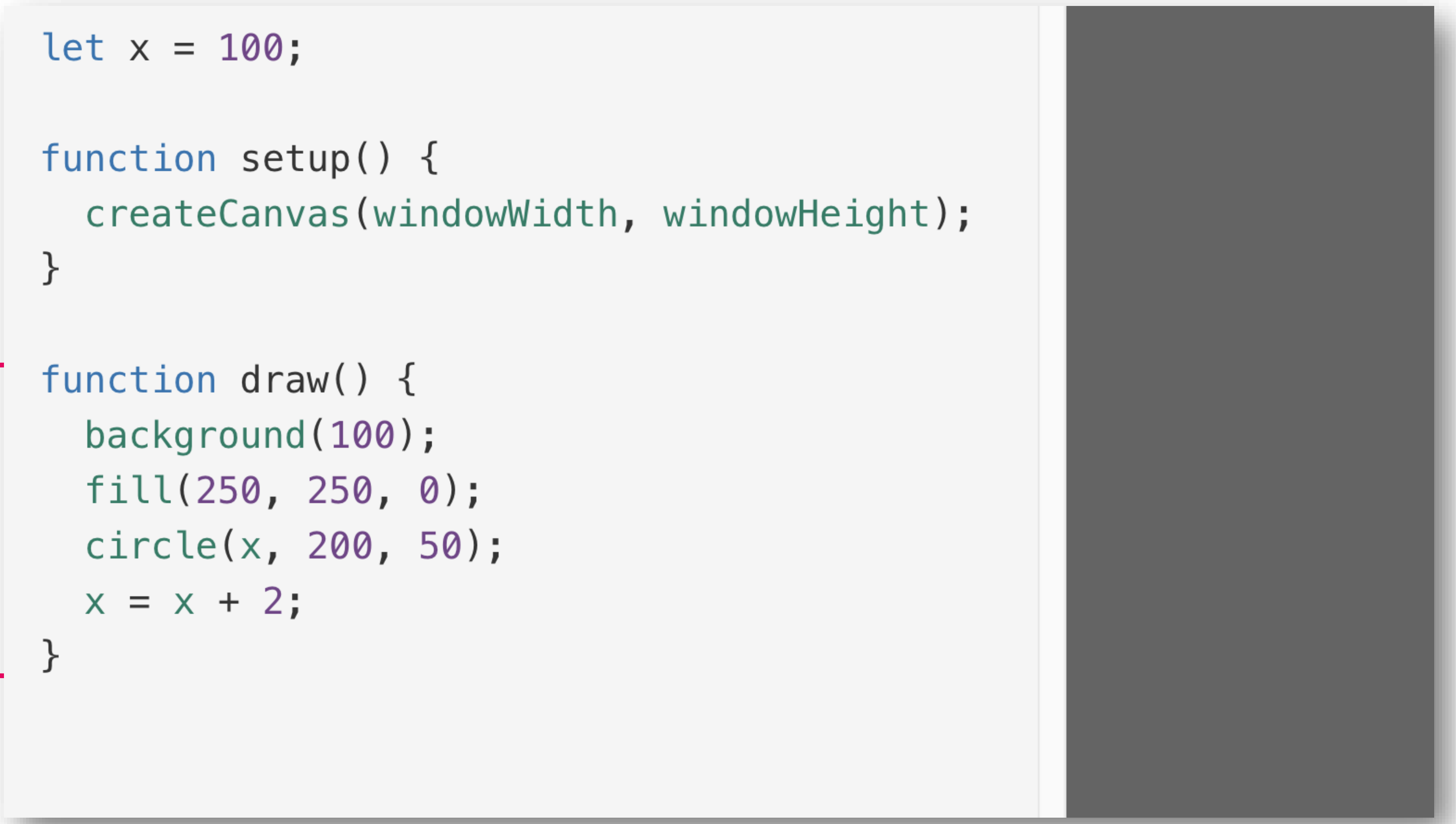
The computer does the commands inside ***draw()*** over and over again.

60 times per second.

It's like a flip book.

https://www.youtube.com/watch?v=JVzf9rtgf9Y

The Magic of draw()

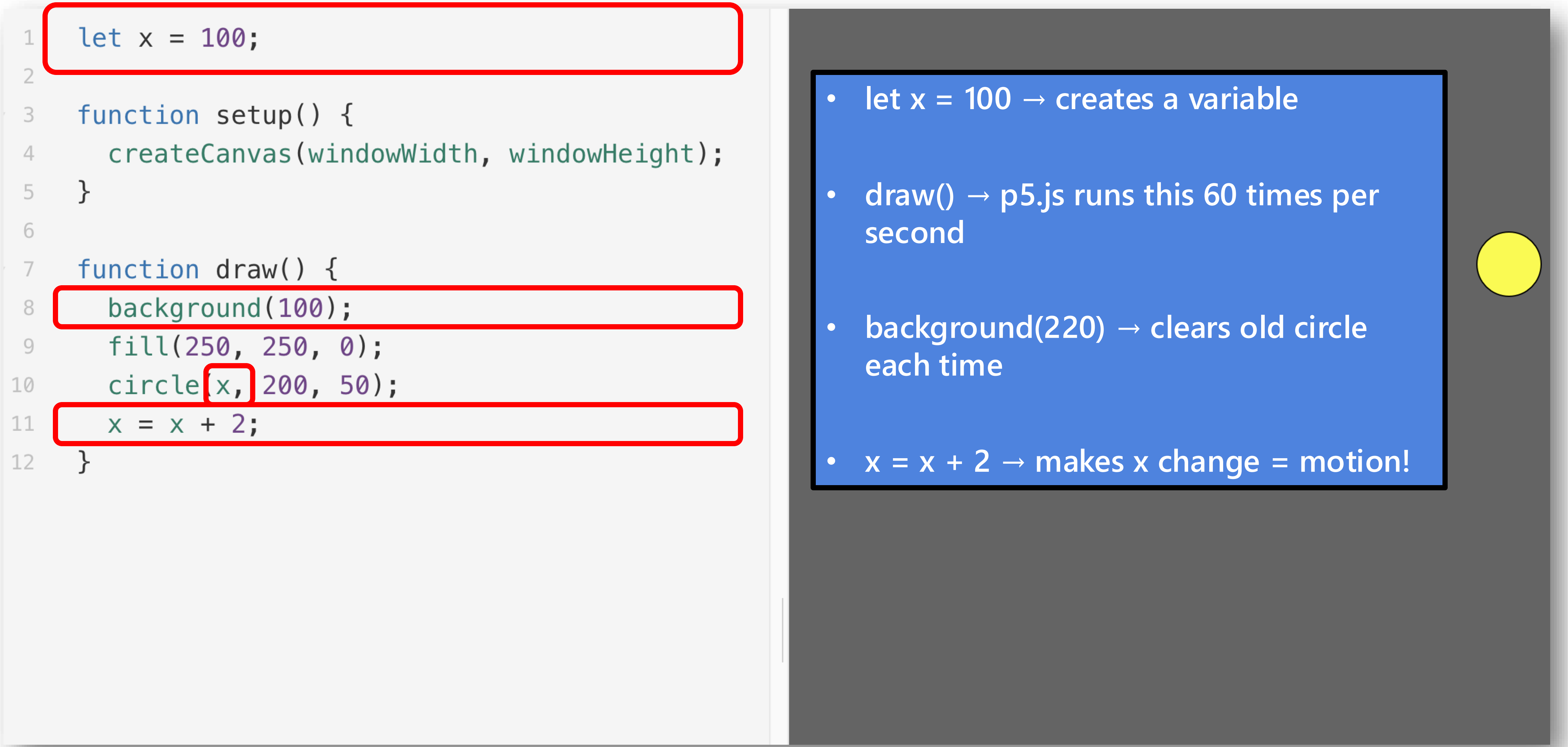


```
let x = 100;

function setup() {
  createCanvas(windowWidth, windowHeight);
}

function draw() {
  background(100);
  fill(250, 250, 0);
  circle(x, 200, 50);
  x = x + 2;
}
```

happens only 1x

happens 60x per second

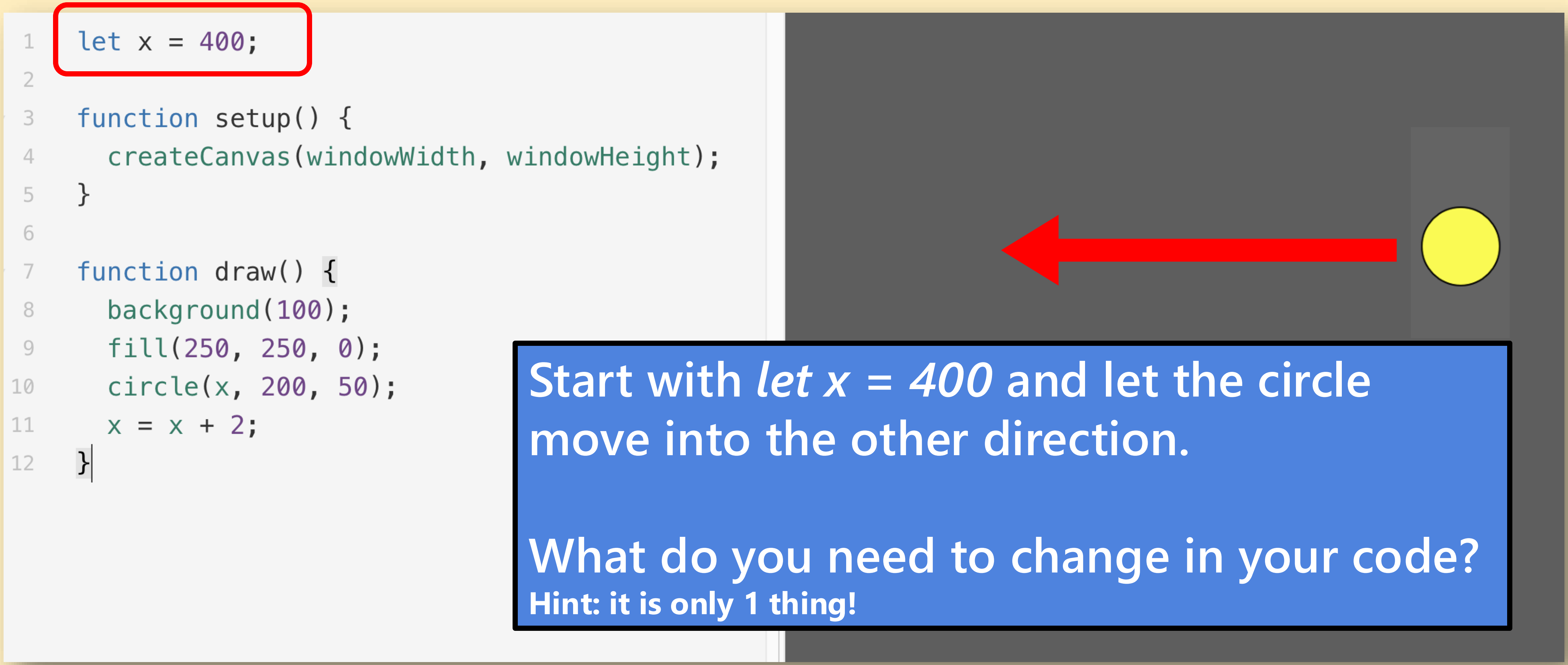
Let‘s break it down…



```
let x = 100;

function setup() {
  createCanvas(windowWidth, windowHeight);
}

function draw() {
  background(100);
  fill(250, 250, 0);
  circle(x, 200, 50);
  x = x + 2;
}
```

- let x = 100 → creates a variable
- draw() → p5.js runs this 60 times per second
- background(220) → clears old circle each time
- x = x + 2 → makes x change = motion!

Mini-Challenge: Change direction !



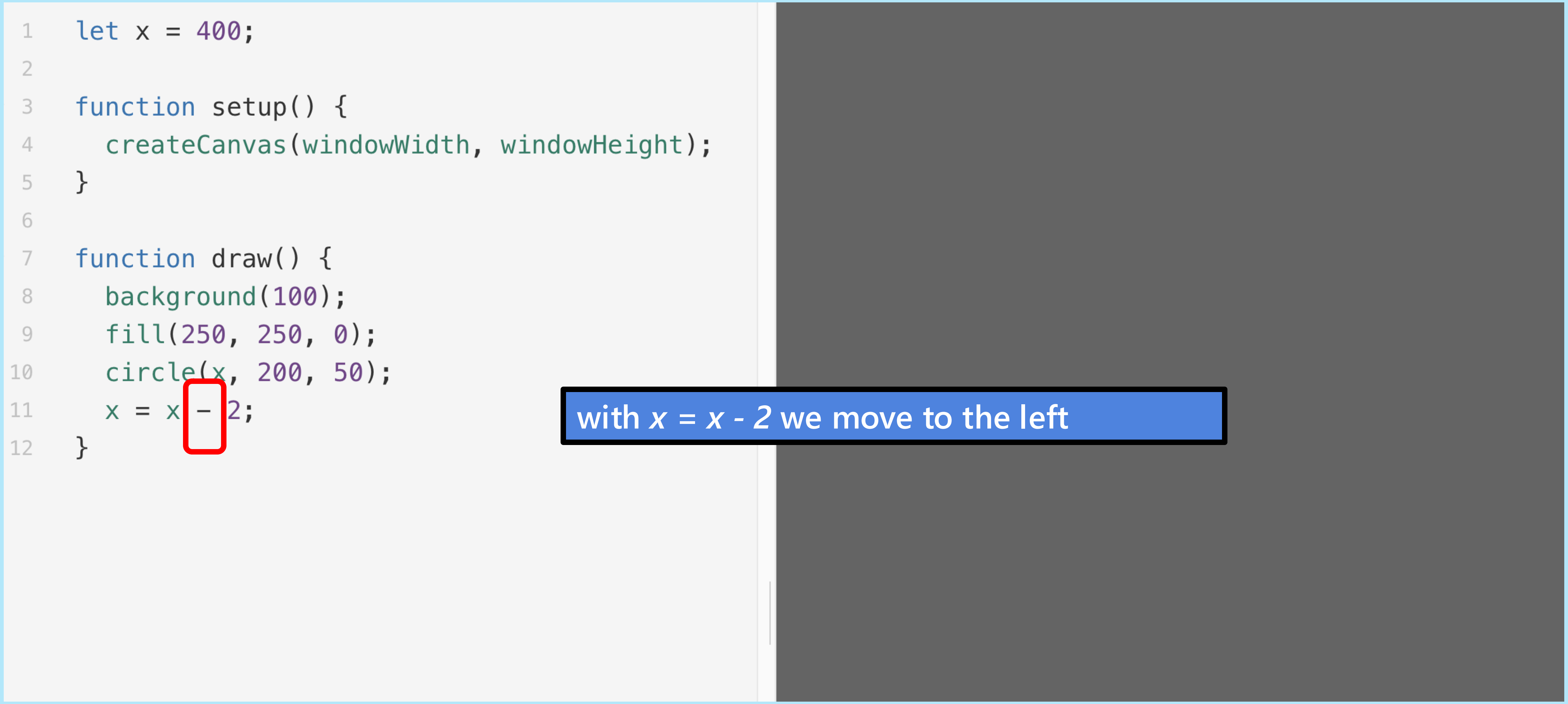
```
let x = 400;

function setup() {
  createCanvas(windowWidth, windowHeight);
}

function draw() {
  background(100);
  fill(250, 250, 0);
  circle(x, 200, 50);
  x = x + 2;
}
```

Start with *let x = 400* and let the circle move into the other direction.

What do you need to change in your code?

Hint: it is only 1 thing!

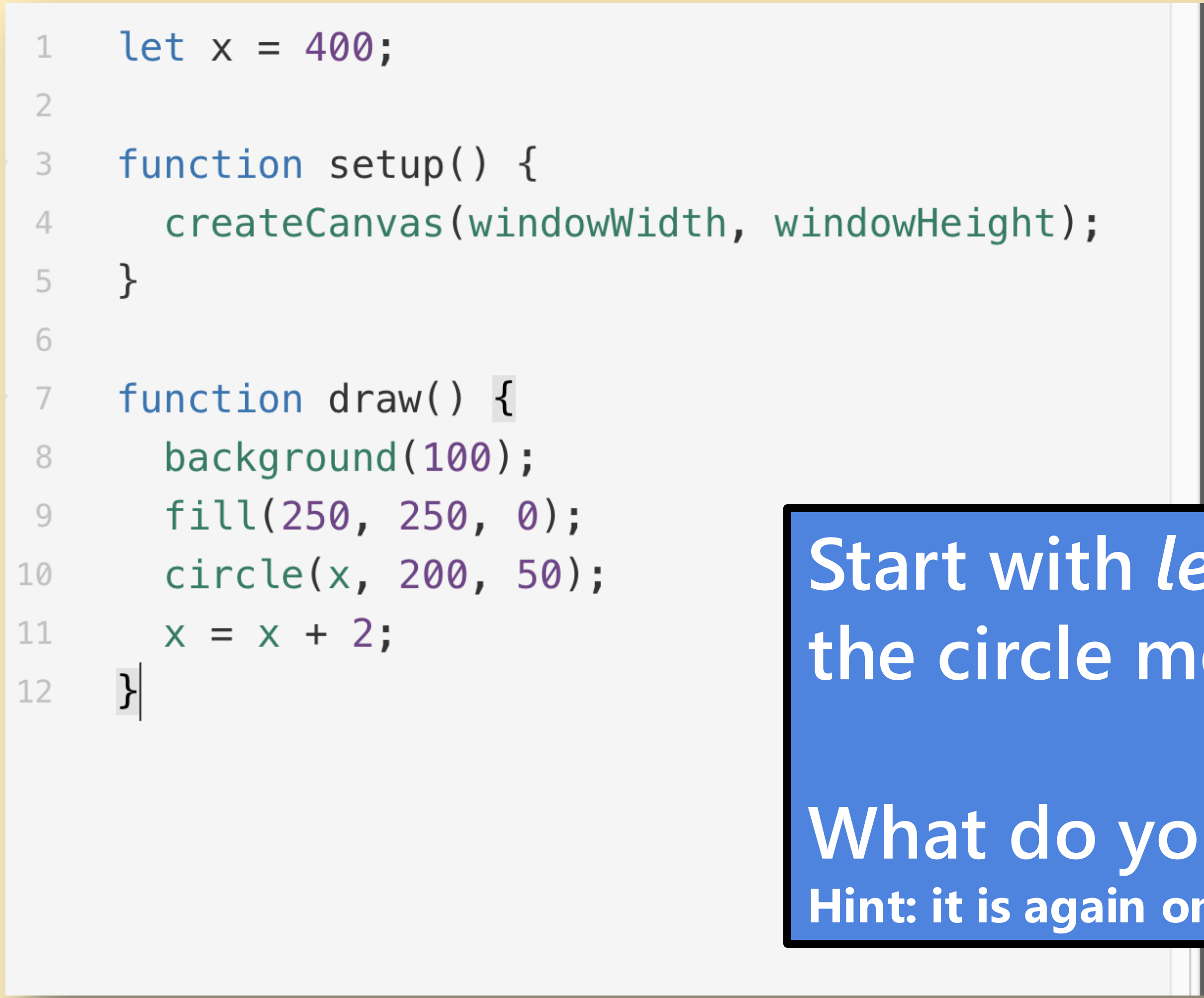
Change direction



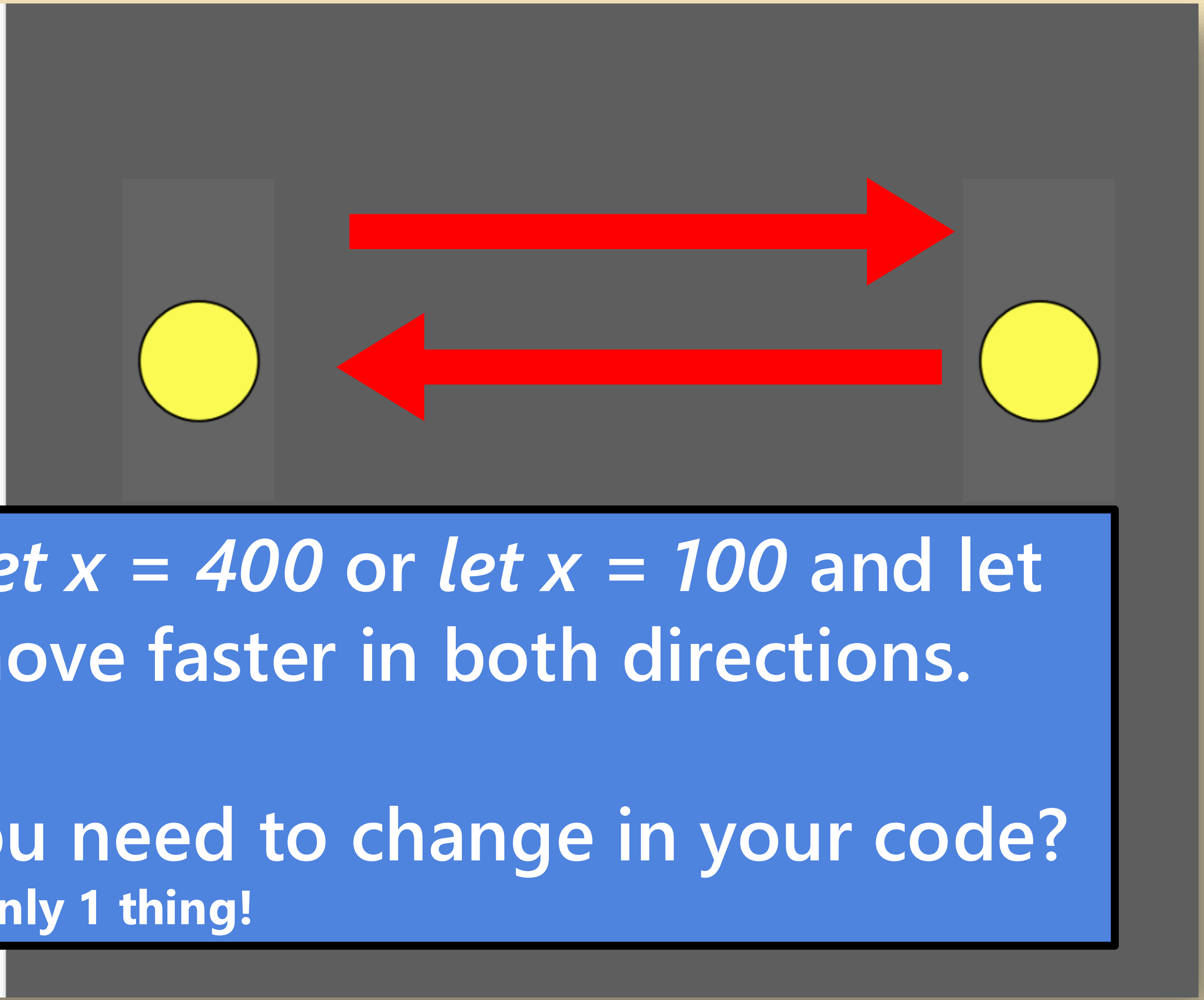
```
let x = 400;

function setup() {
  createCanvas(windowWidth, windowHeight);
}

function draw() {
  background(100);
  fill(250, 250, 0);
  circle(x, 200, 50);
  x = x - 2;
}
```

with *x* = *x - 2* we move to the left

Mini-Challenge: Move it faster!



```
let x = 400;

function setup() {
  createCanvas(windowWidth, windowHeight);
}

function draw() {
  background(100);
  fill(250, 250, 0);
  circle(x, 200, 50);
  x = x + 2;
}
```

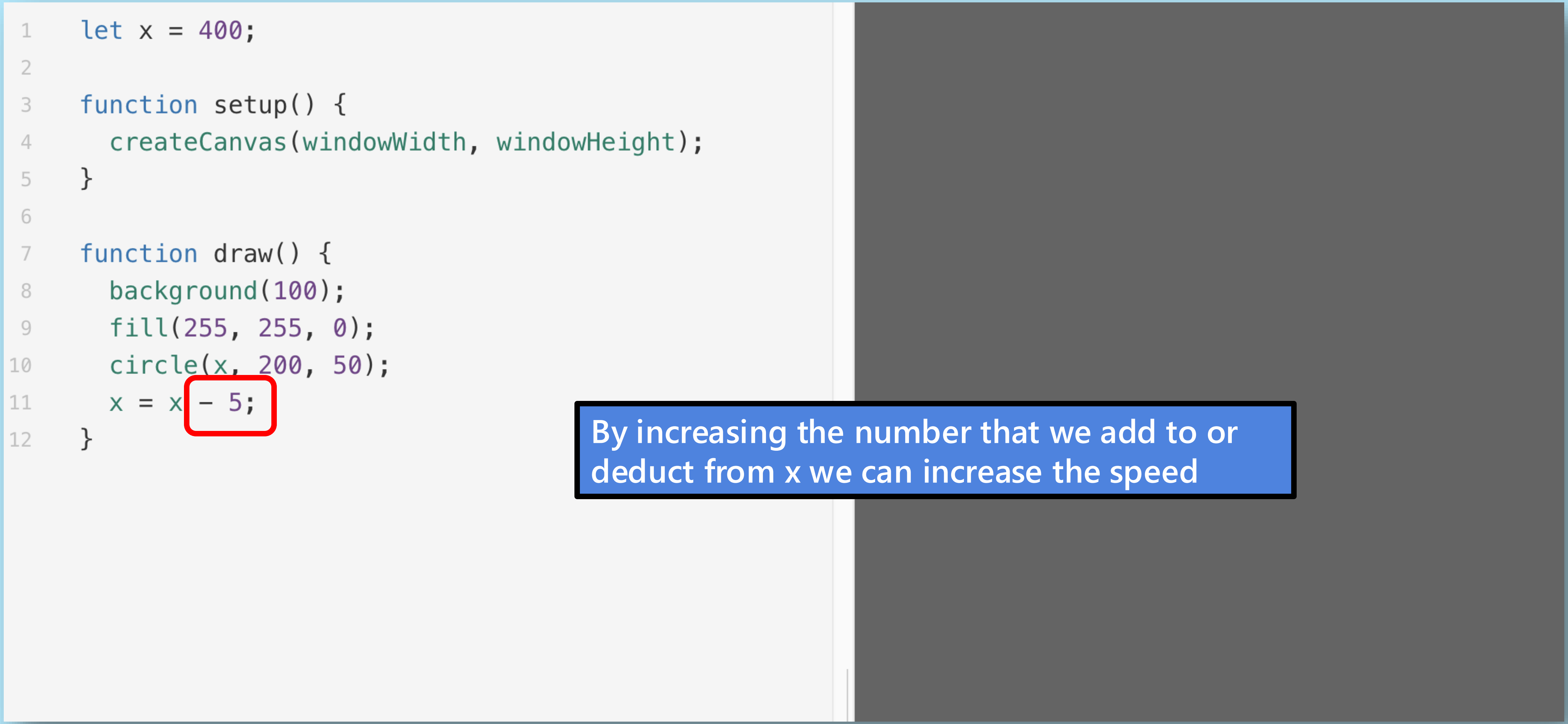


Start with *let x = 400* or *let x = 100* and let the circle move faster in both directions.

What do you need to change in your code?

Hint: it is again only 1 thing!

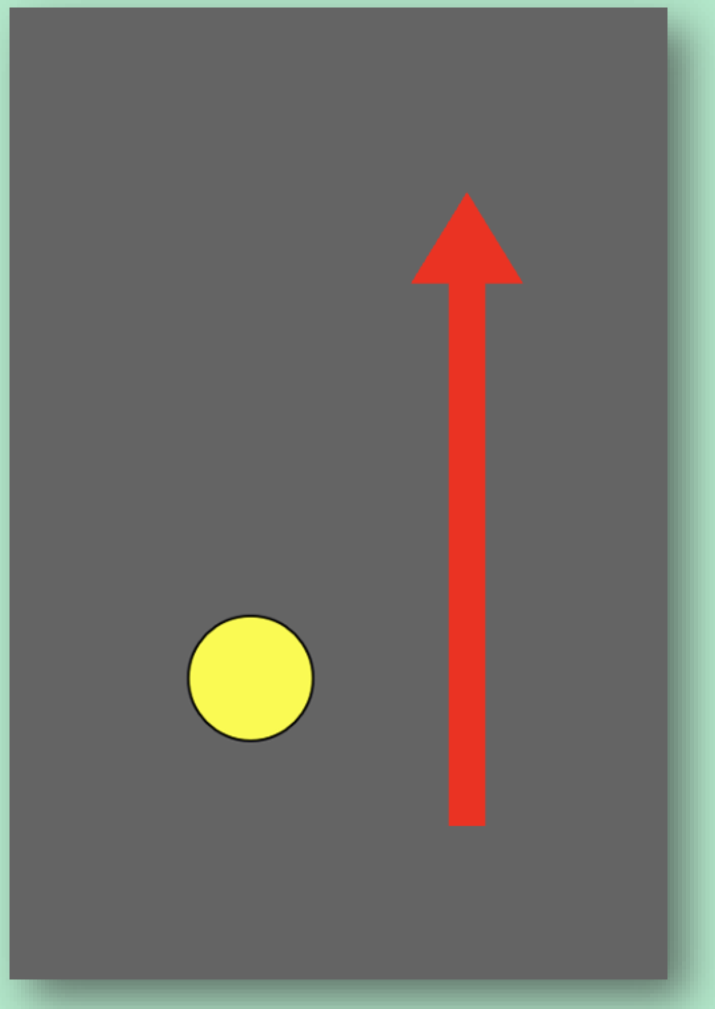
Move it faster

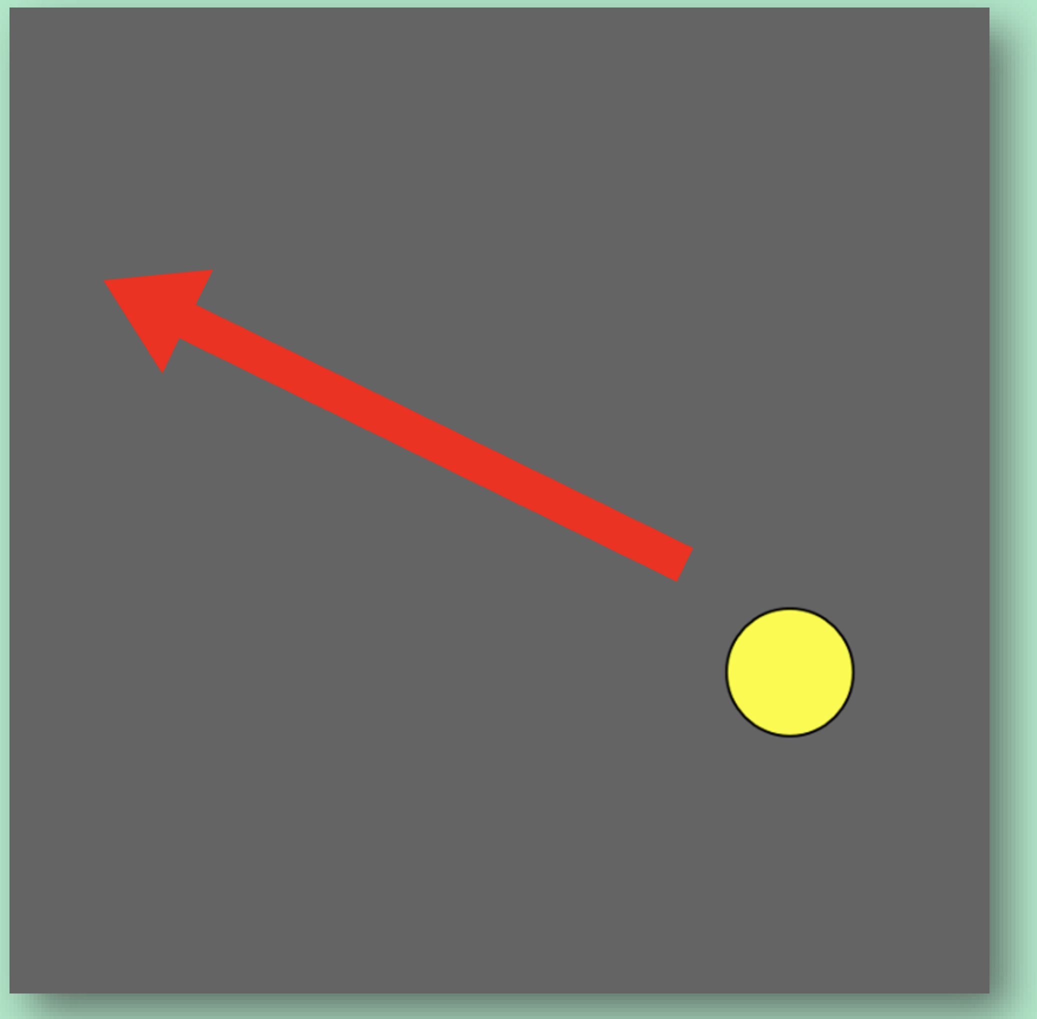


```
let x = 400;

function setup() {
  createCanvas(windowWidth, windowHeight);
}

function draw() {
  background(100);
  fill(255, 255, 0);
  circle(x, 200, 50);
  x = x - 5;
}
```

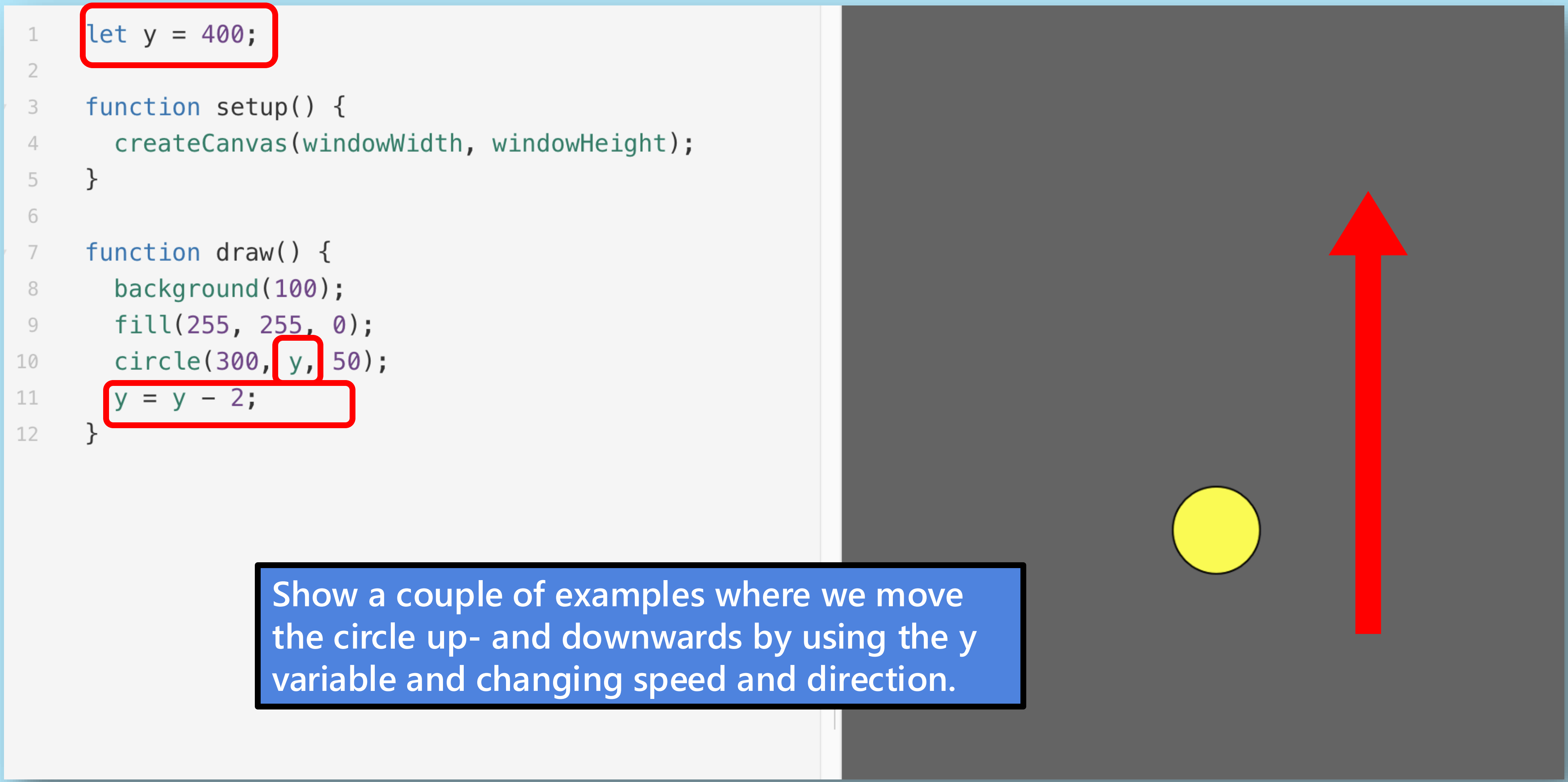
By increasing the number that we add to or deduct from x we can increase the speed

How can we move up & down & diagonally?





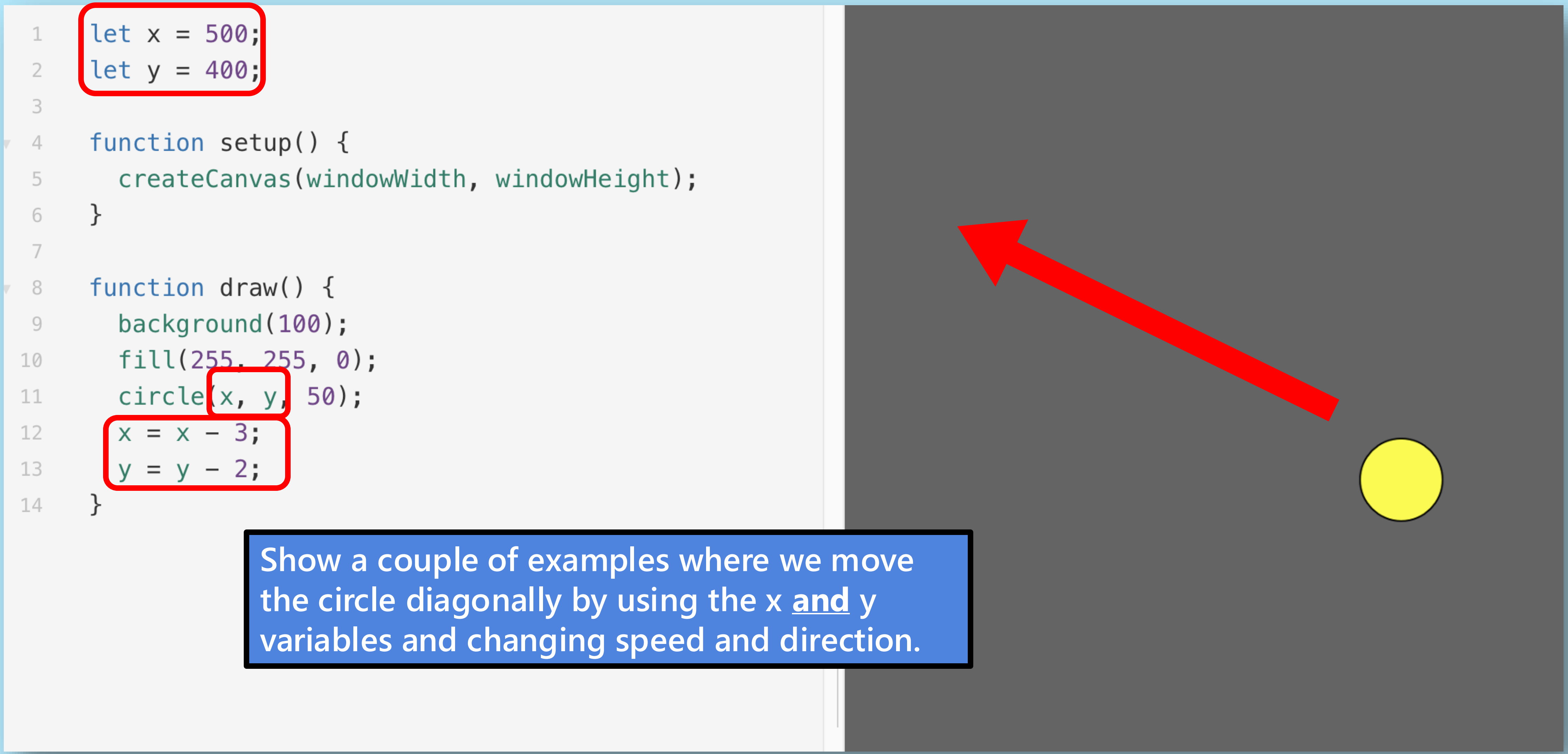
Up & down: change y direction



```
let y = 400;

function setup() {
  createCanvas(windowWidth, windowHeight);
}

function draw() {
  background(100);
  fill(255, 255, 0);
  circle(300, y, 50);
  y = y - 2;
}
```

Show a couple of examples where we move the circle up- and downwards by using the y variable and changing speed and direction.

Add x and y direction



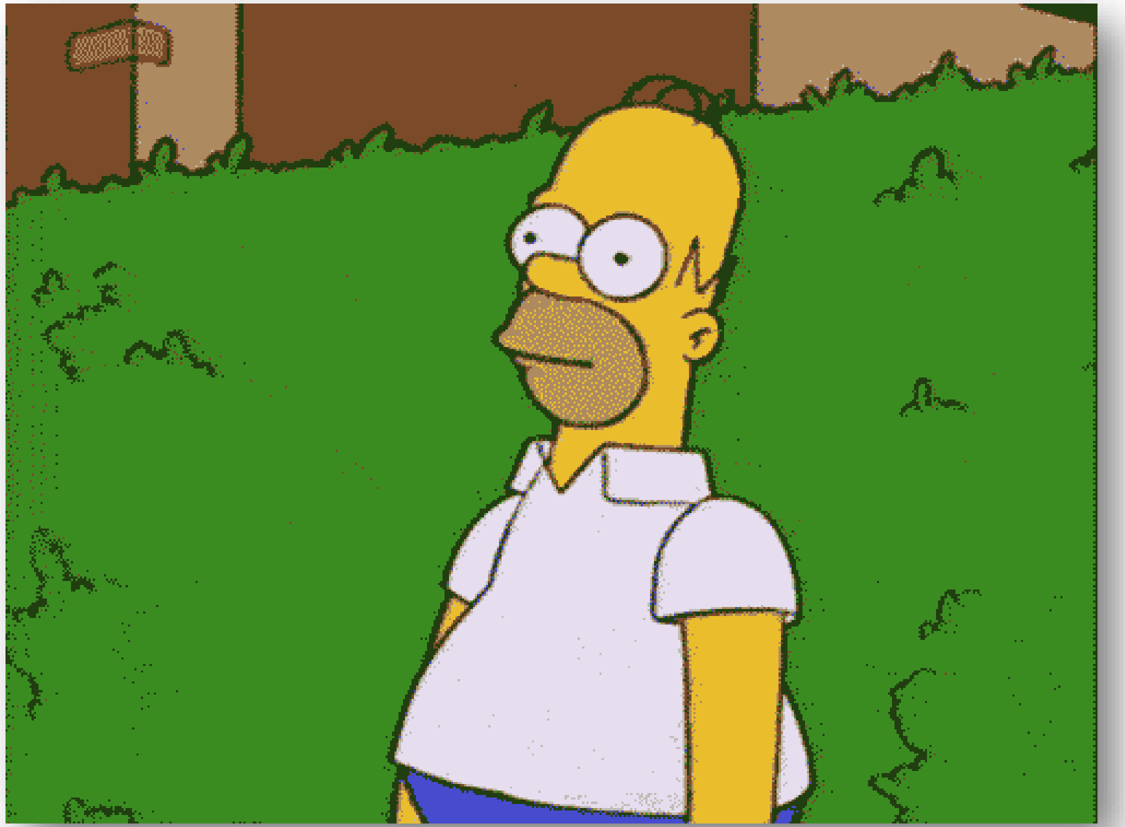
```
let x = 500;
let y = 400;

function setup() {
  createCanvas(windowWidth, windowHeight);
}

function draw() {
  background(100);
  fill(255, 255, 0);
  circle(x, y, 50);
  x = x - 3;
  y = y - 2;
}
```

Show a couple of examples where we move the circle diagonally by using the x **and** y variables and changing speed and direction.

But the circle always disappears

Now, we still have one major problem: the circle always disappears from the canvas…

To solve this, we need to know one more concept called **Conditionals**.



if.... else ....

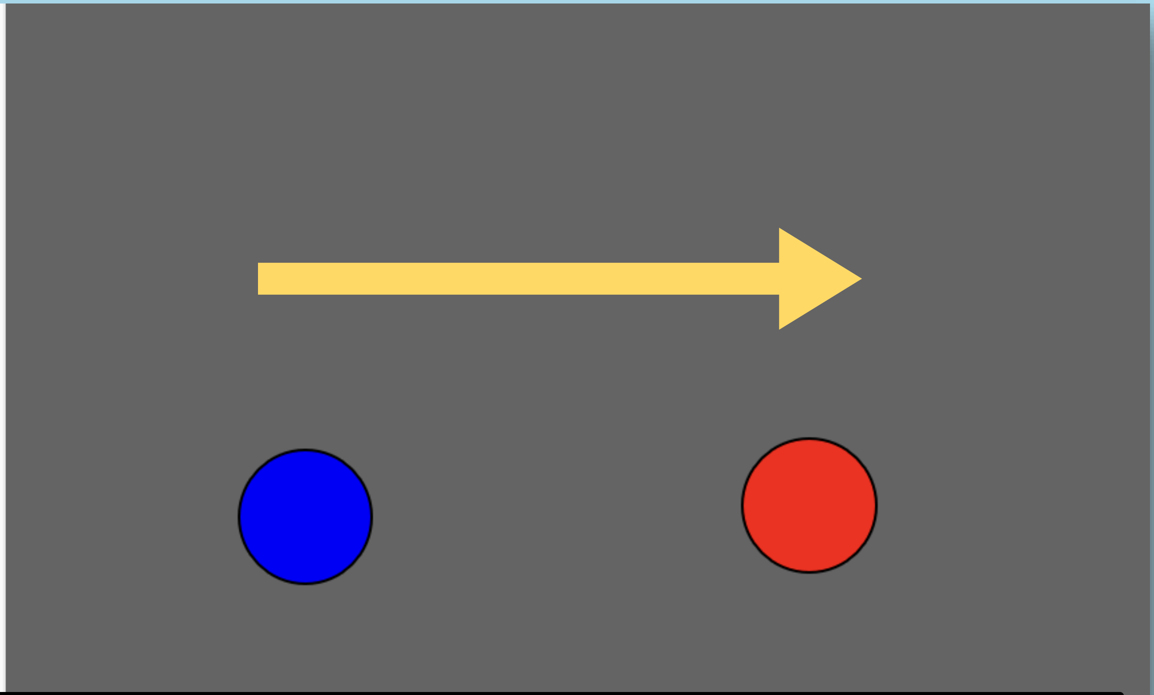
How to let the program decide?

Sometimes we want the computer to **make a decision**.

For example: “If the circle is on the left side, make it blue. Otherwise, make it red.”

Circle that changes colour based on position

```
let x = 100;

function setup() {
  createCanvas(windowWidth, windowHeight);
}

function draw() {
  background(100);

  if (x < 300) {
    fill(0, 0, 255);  // blue
  } else {
    fill(255, 0, 0);  // red
  }

  circle(x, 300, 50);
  x = x + 2;
}
```



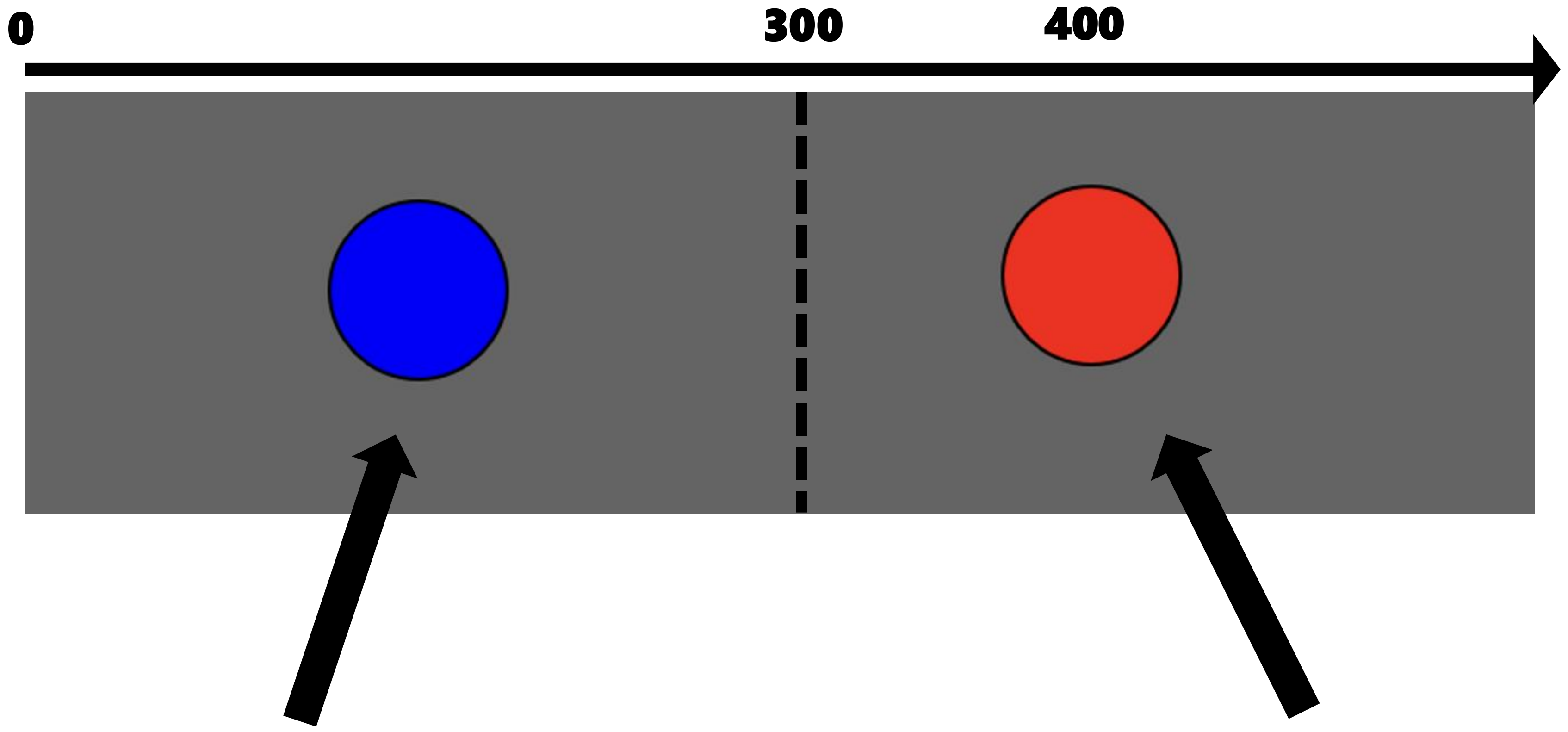
Circle starts blue and becomes red at 300px on the x axis.

Explain concepts:

- *if (...) { ... } else { ... }*
- only one of the blocks runs at a time
- Computer checks constantly "Is x less than 300?"

We check the x-position of the circle

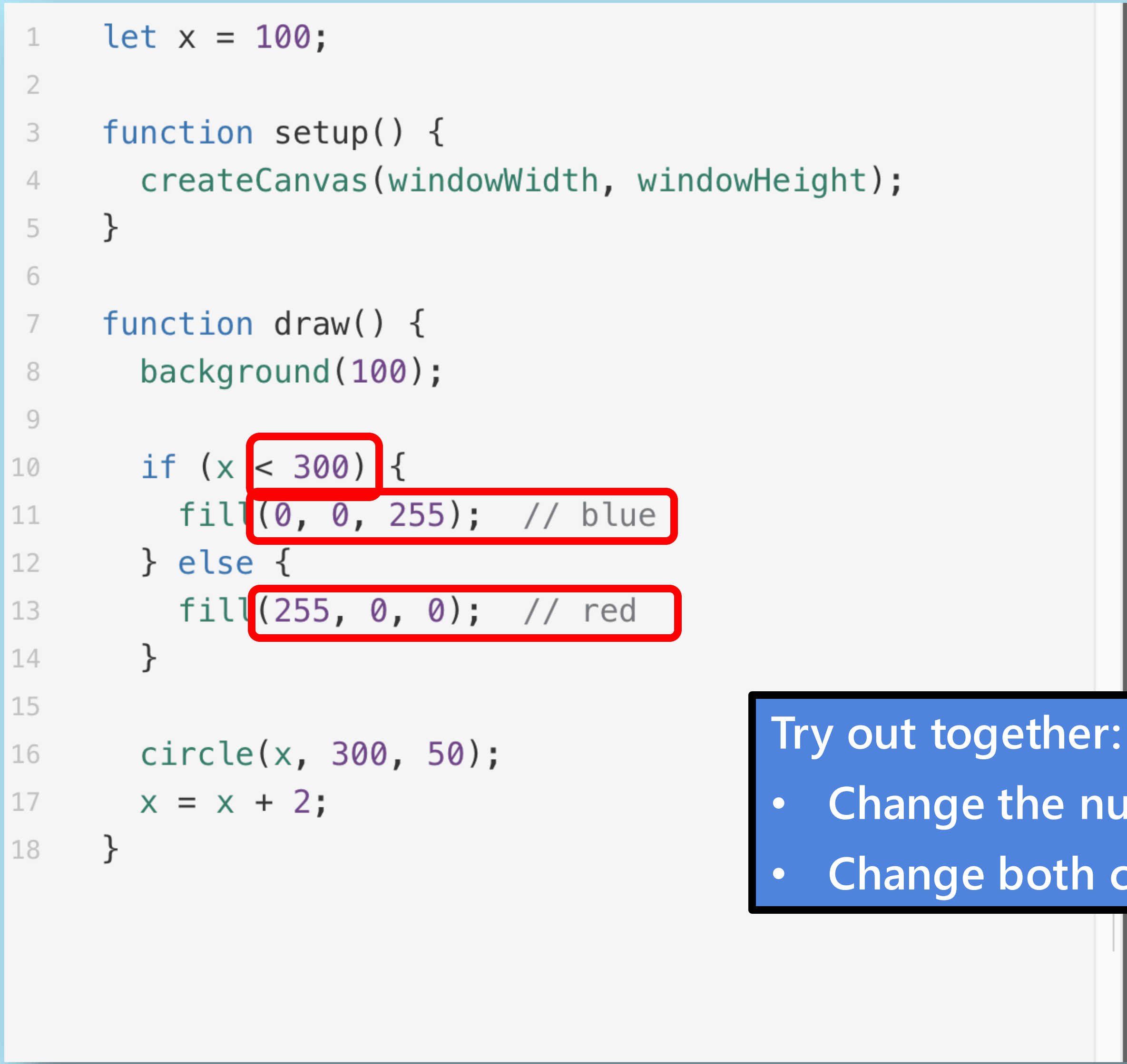
```
if (x < 300) {
  fill(0, 0, 255);  // blue
} else {
  fill(255, 0, 0);  // red
}
```



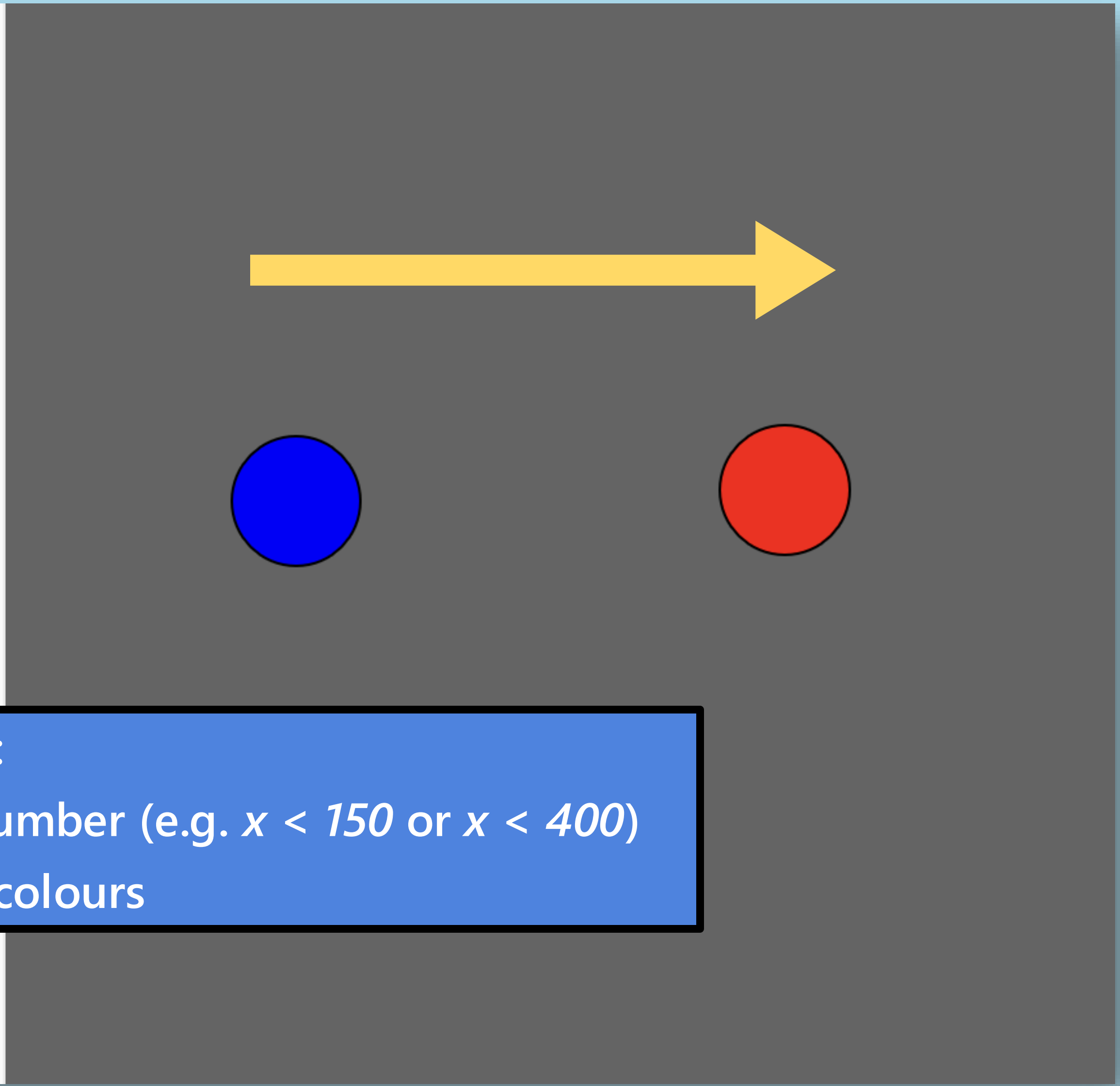
IF the x-value is smaller than 300: make the circle blue

ELSE = the x-value is 300 or larger: make the circle red

Circle that changes colour based on position



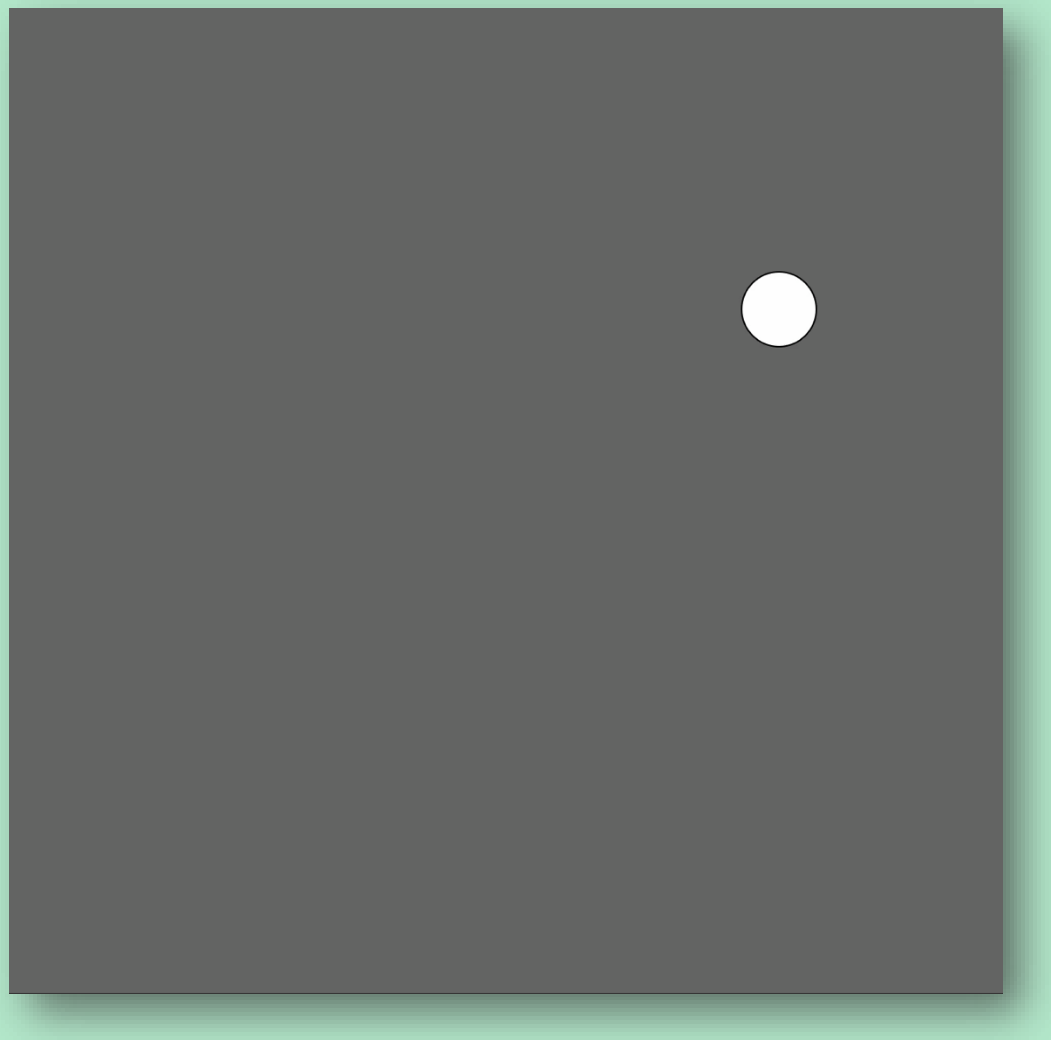
```
let x = 100;

function setup() {
  createCanvas(windowWidth, windowHeight);
}

function draw() {
  background(100);

  if (x < 300) {
    fill(0, 0, 255);   // blue
  } else {
    fill(255, 0, 0);   // red
  }

  circle(x, 300, 50);
  x = x + 2;
}
```



Try out together:

- Change the number (e.g. *x < 150* or *x < 400*)
- Change both colours

How can we apply this to bounce off the edges?



How to ask question in code

`>`	greater than
`<`	less than
`===`	equal to
`!==`	not equal
`&&`	AND (both most be true)
`||`	OR (either can be true)

Comparison Operators

Logical Operators

Examples

7 > 4	✅	true
3 > 10	❌	false
5 < 9	✅	true
100 < 50	❌	false
10 === 10	✅	true
7 !== 7.5	✅	true

>	greater than
<	less than
===	equal to
!==	not equal
&&	AND (both most be true)
||	OR (either can be true)

True or False?

50 > 10	✓	true
12 < 6	✗	false
130 > 129	✓	true
4 !== 4.1	✓	true

>	greater than
<	less than
===	equal to
!==	not equal
&&	AND (both most be true)
||	OR (either can be true)

Examples

true || false	✓	true
false || false	✗	false
false || true	✓	true

If either is true, result is true.

true && true	✓	true
false && false	✗	false
true && false	✗	false

Both must be true at the same time.

>	greater than
<	less than
===	equal to
!==	not equal
&&	AND (both most be true)
||	OR (either can be true)

True or False?

>	greater than
<	less than
===	equal to
!==	not equal
&&	AND (both most be true)
||	OR (either can be true)

5 > 3 && 5 < 9 ✓ true

5 > 3 && 5 > 9 ✗ false

75 > 100 || 90 < 100 ✓ true

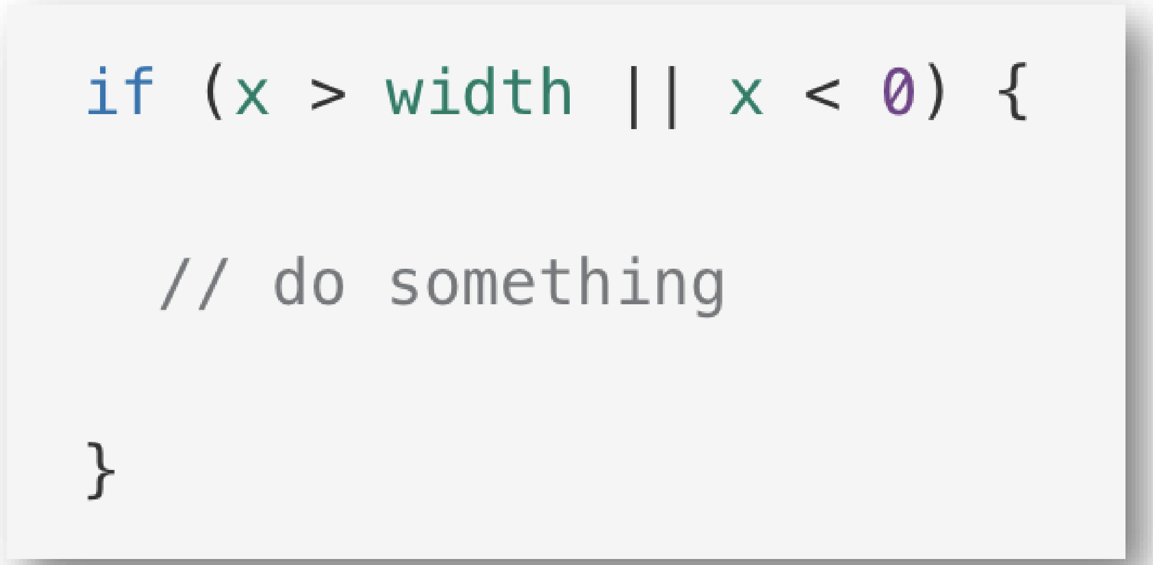
```
x = 50;
x > 100 || x < 100
```

✓ true

Why do we need operators?

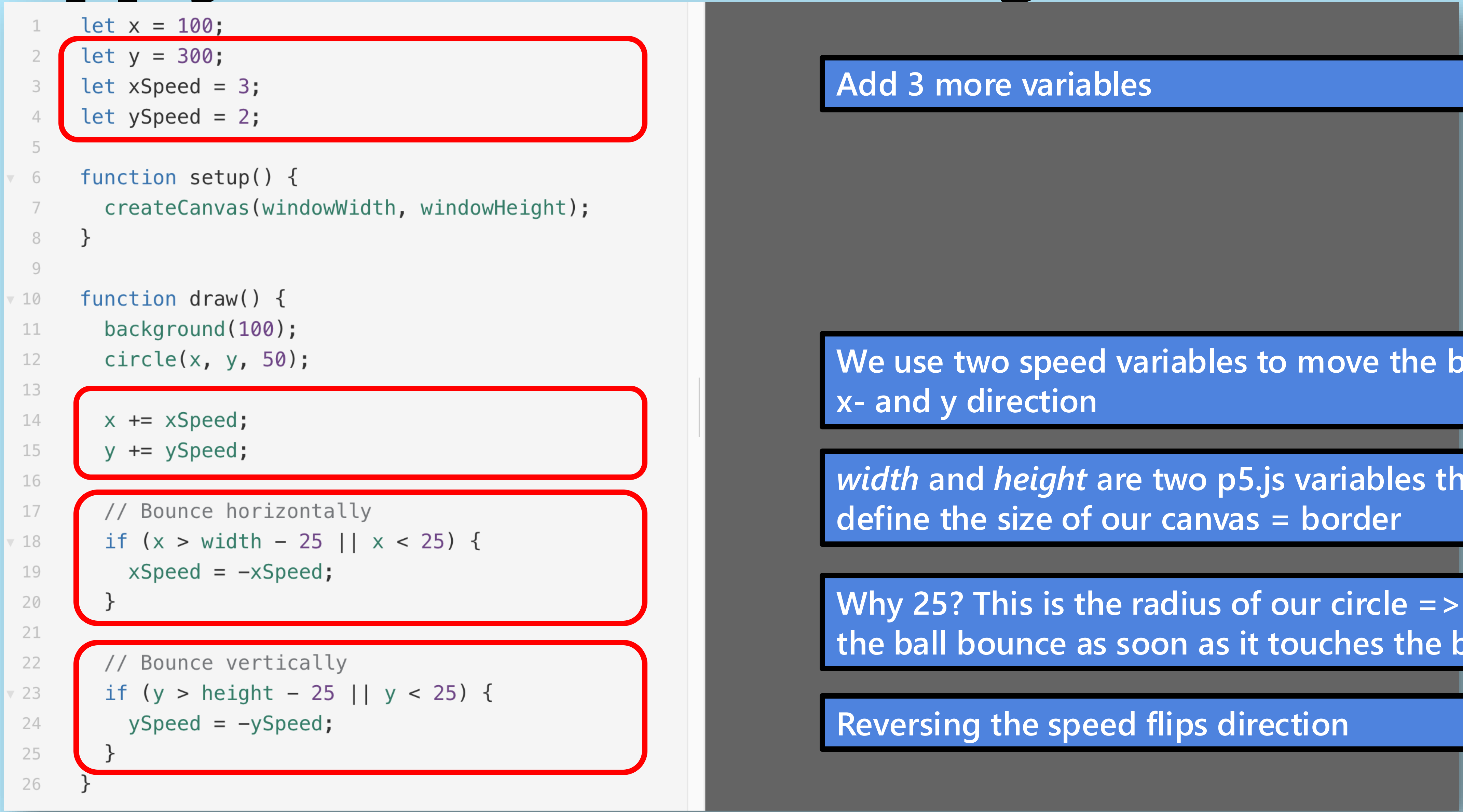
We use these logic checks to make the computer make decisions, like

- bouncing
- scoring points
- changing colors



```
if (x > width || x < 0) {

  // do something

}
```

Apply *if* to bounce off edges



```
let x = 100;
let y = 300;
let xSpeed = 3;
let ySpeed = 2;

function setup() {
  createCanvas(windowWidth, windowHeight);
}

function draw() {
  background(100);
  circle(x, y, 50);

  x += xSpeed;
  y += ySpeed;

  // Bounce horizontally
  if (x > width - 25 || x < 25) {
    xSpeed = -xSpeed;
  }

  // Bounce vertically
  if (y > height - 25 || y < 25) {
    ySpeed = -ySpeed;
  }
}
```

Add 3 more variables

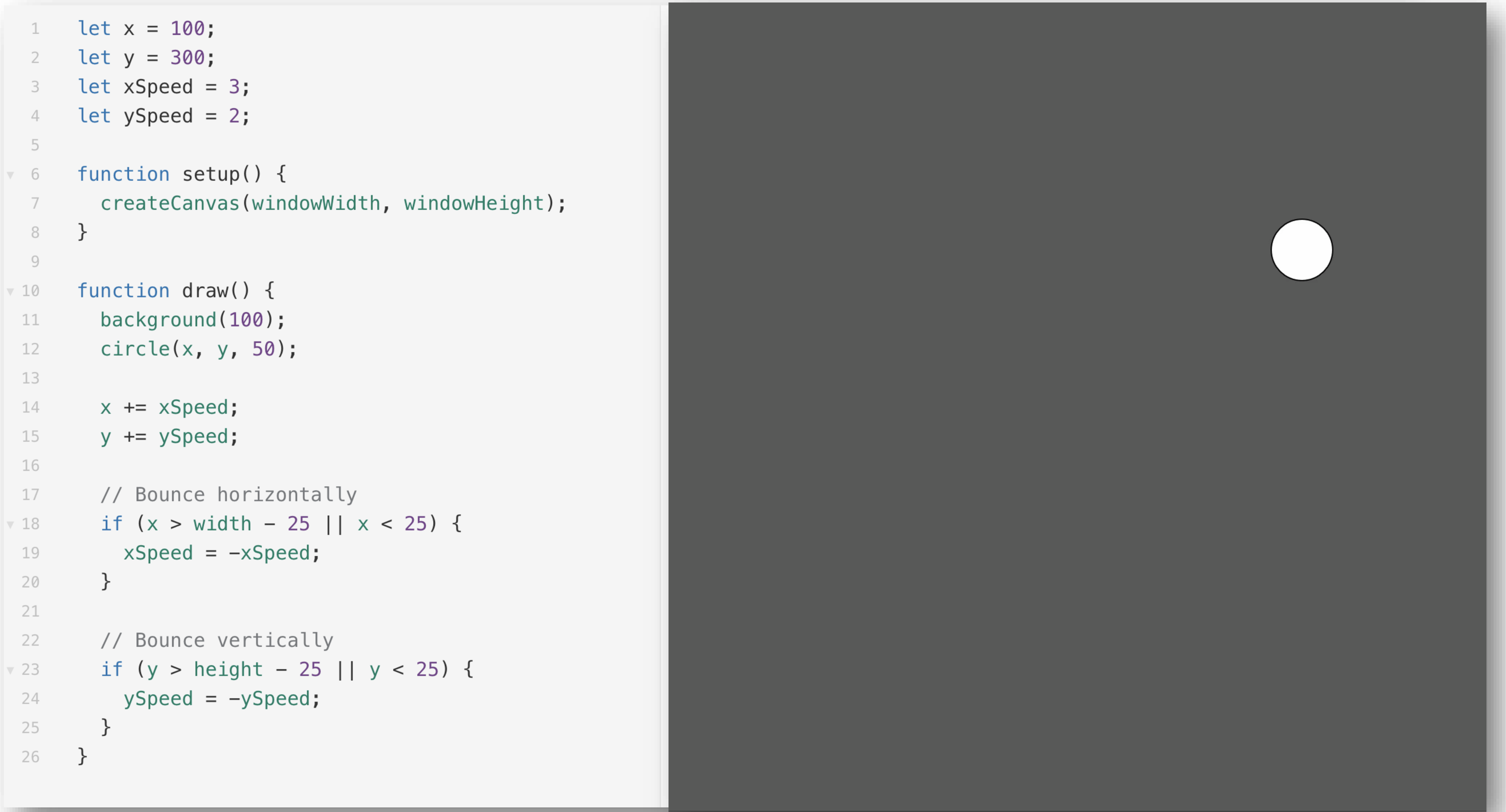
We use two speed variables to move the ball in x- and y direction

width and *height* are two p5.js variables that define the size of our canvas = border

Why 25? This is the radius of our circle => makes the ball bounce as soon as it touches the border.

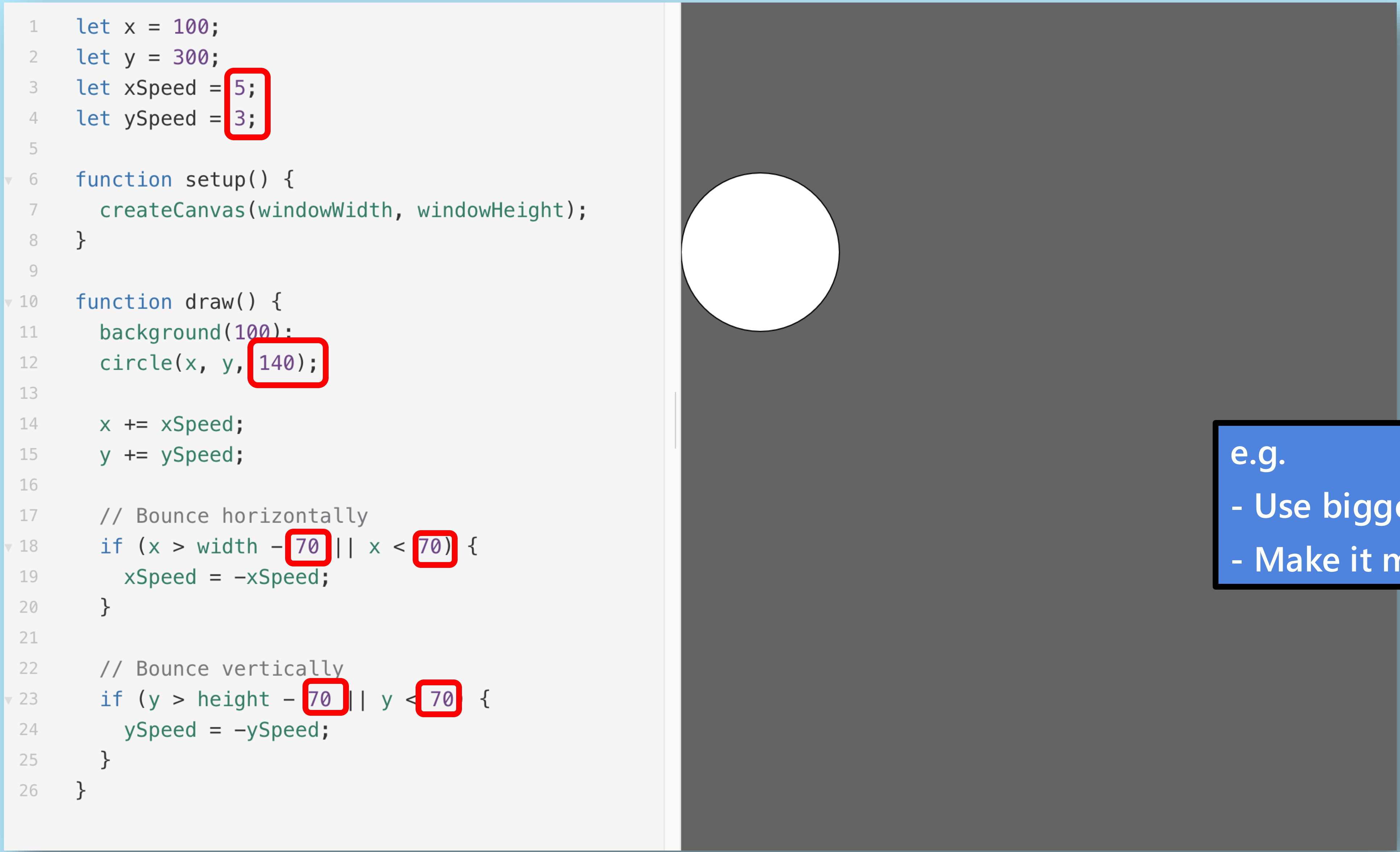
Reversing the speed flips direction

Apply *if* to bounce off edges



```
let x = 100;
let y = 300;
let xSpeed = 3;
let ySpeed = 2;

function setup() {
  createCanvas(windowWidth, windowHeight);
}

function draw() {
  background(100);
  circle(x, y, 50);

  x += xSpeed;
  y += ySpeed;

  // Bounce horizontally
  if (x > width - 25 || x < 25) {
    xSpeed = -xSpeed;
  }

  // Bounce vertically
  if (y > height - 25 || y < 25) {
    ySpeed = -ySpeed;
  }
}
```

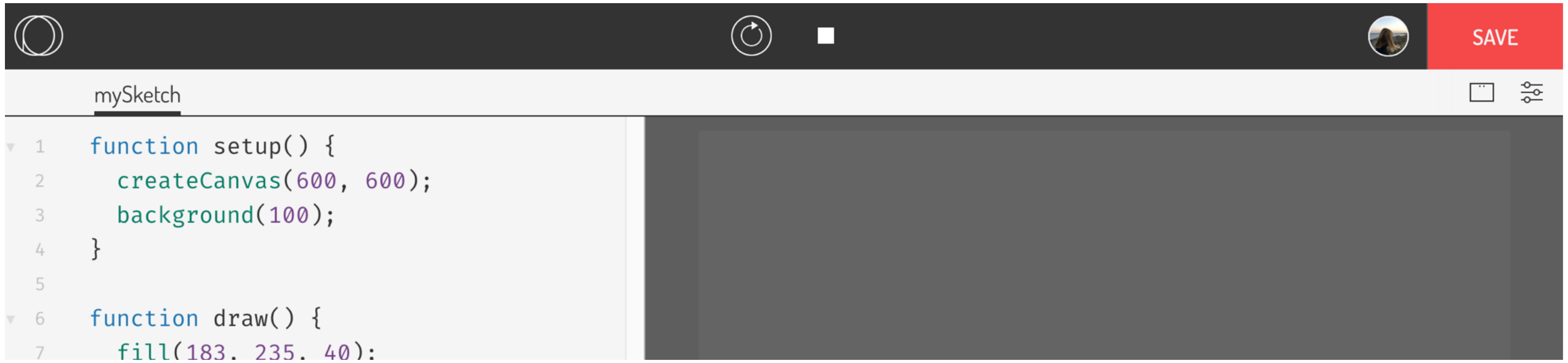
Variations



```
let x = 100;
let y = 300;
let xSpeed = 5;
let ySpeed = 3;

function setup() {
  createCanvas(windowWidth, windowHeight);
}

function draw() {
  background(100);
  circle(x, y, 140);

  x += xSpeed;
  y += ySpeed;

  // Bounce horizontally
  if (x > width - 70 || x < 70) {
    xSpeed = -xSpeed;
  }

  // Bounce vertically
  if (y > height - 70 || y < 70) {
    ySpeed = -ySpeed;
  }
}
```

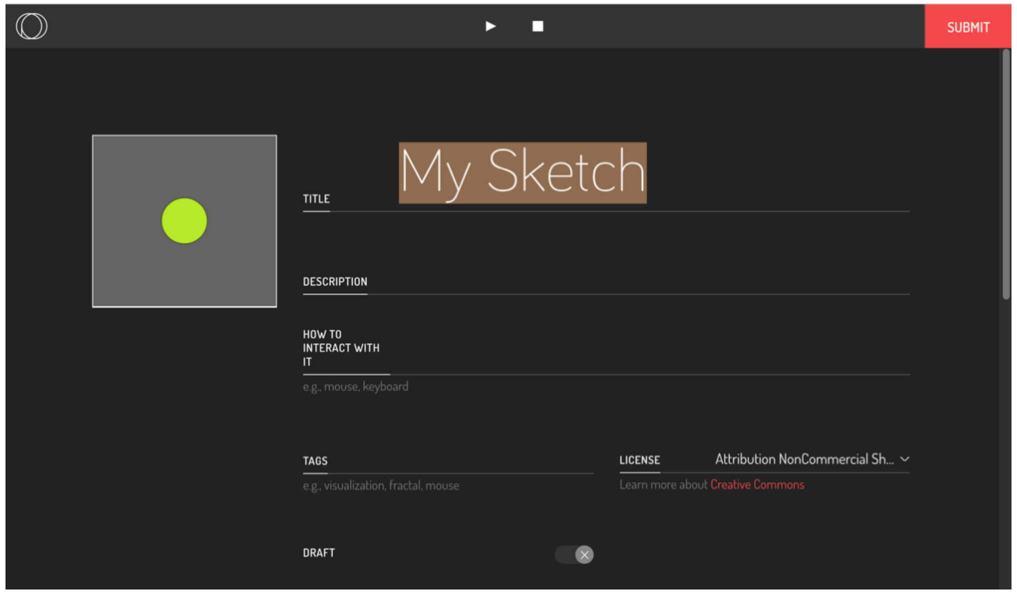
e.g.
- Use bigger / smaller circle
- Make it move faster / slower

Save



```
function setup() {
  createCanvas(600, 600);
  background(100);
}

function draw() {
  fill(183, 235, 40);
```

1 Click on *SAVE*


SUBMIT
TITLE
My Sketch
DESCRIPTION
HOW TO INTERACT WITH IT
e.g. mouse, keyboard
TAGS
e.g. visualization, fractal, mouse
LICENSE
Attribution NonCommercial Sh...
Learn more about Creative Commons
DRAFT

3 Click on *SUBMIT*

2 Give the sketch a new title instead of *„My Sketch"* e.g. *„Circles"*

Challenge – Customize your Sketch

1.🌈 Change colour on bounce:

e.g. with

**fill(random(255),
    random(255),
    random(255));**

```
fill(random(255), random(255), random(255));
```

2. 👻 Leave a trail (fading background):

e.g. with

background(220,20);

```
background(220, 20);
```

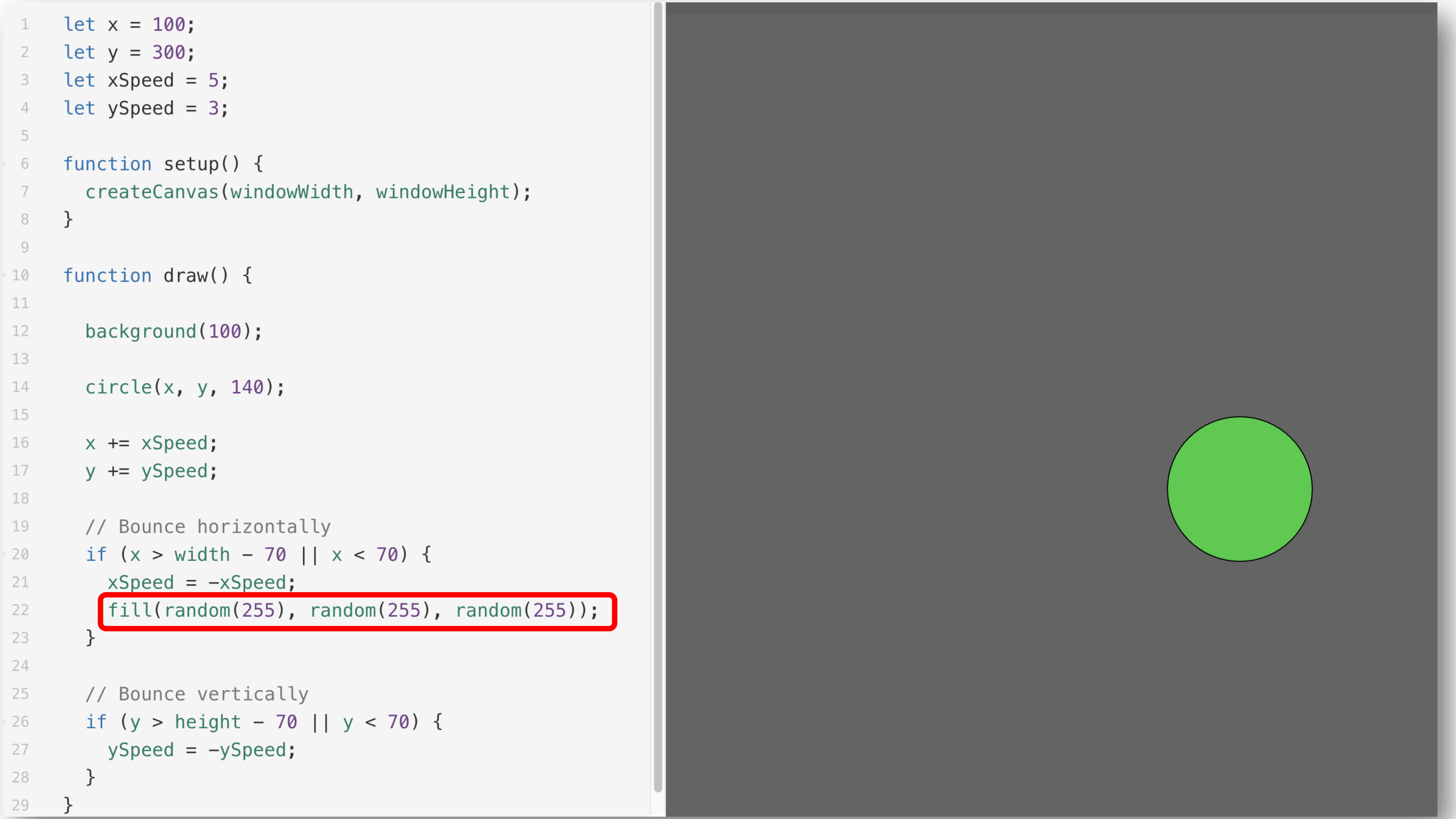
3. 👽 Replace circle with another shape:

e.g. with

```
fill(100, 255, 100);
arc(x, y, 80, 60, 0, PI); // body

fill(0);
circle(x - 20, y - 20, 10); // eye
circle(x + 20, y - 20, 10); // eye

line(x - 15, y - 5, x + 15, y - 5); // mouth
```

Examples for customization

1. Change colour on bounce



```javascript
let x = 100;
let y = 300;
let xSpeed = 5;
let ySpeed = 3;

function setup() {
  createCanvas(windowWidth, windowHeight);
}

function draw() {

  background(100);

  circle(x, y, 140);

  x += xSpeed;
  y += ySpeed;

  // Bounce horizontally
  if (x > width - 70 || x < 70) {
    xSpeed = -xSpeed;
    fill(random(255), random(255), random(255));
  }

  // Bounce vertically
  if (y > height - 70 || y < 70) {
    ySpeed = -ySpeed;
  }
}
```

random(*min, max*)

We will need the ***random( )*** function to generate random values.

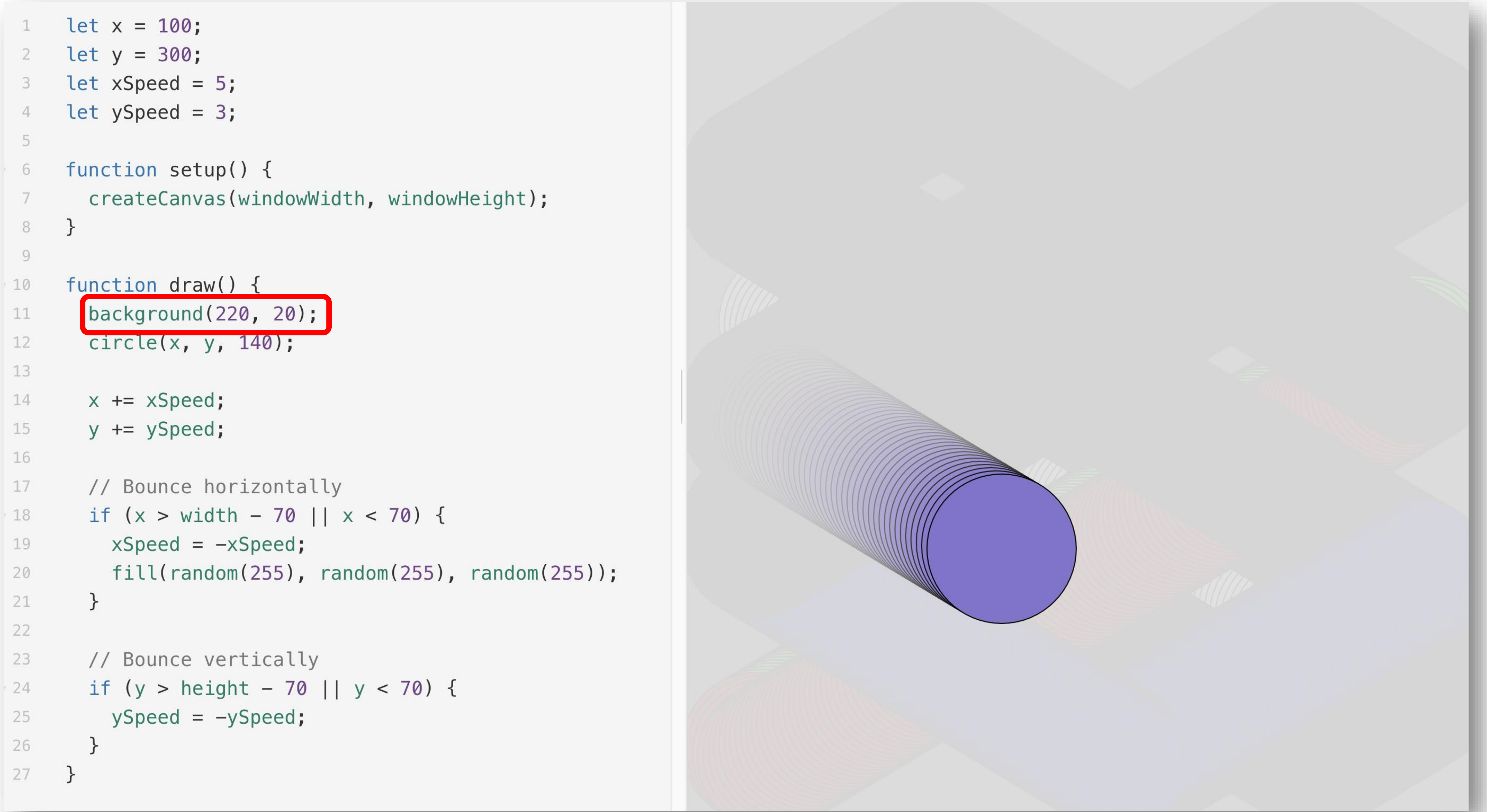
Example

```
random(0,255);
```

$\underbrace{\hphantom{random(0,255);}}$

generates a random value between 0 and 254

2. 👻 Leave a trail (fading background)



```
let x = 100;
let y = 300;
let xSpeed = 5;
let ySpeed = 3;

function setup() {
  createCanvas(windowWidth, windowHeight);
}

function draw() {
  background(220, 20);
  circle(x, y, 140);

  x += xSpeed;
  y += ySpeed;

  // Bounce horizontally
  if (x > width - 70 || x < 70) {
    xSpeed = -xSpeed;
    fill(random(255), random(255), random(255));
  }

  // Bounce vertically
  if (y > height - 70 || y < 70) {
    ySpeed = -ySpeed;
  }
}
```

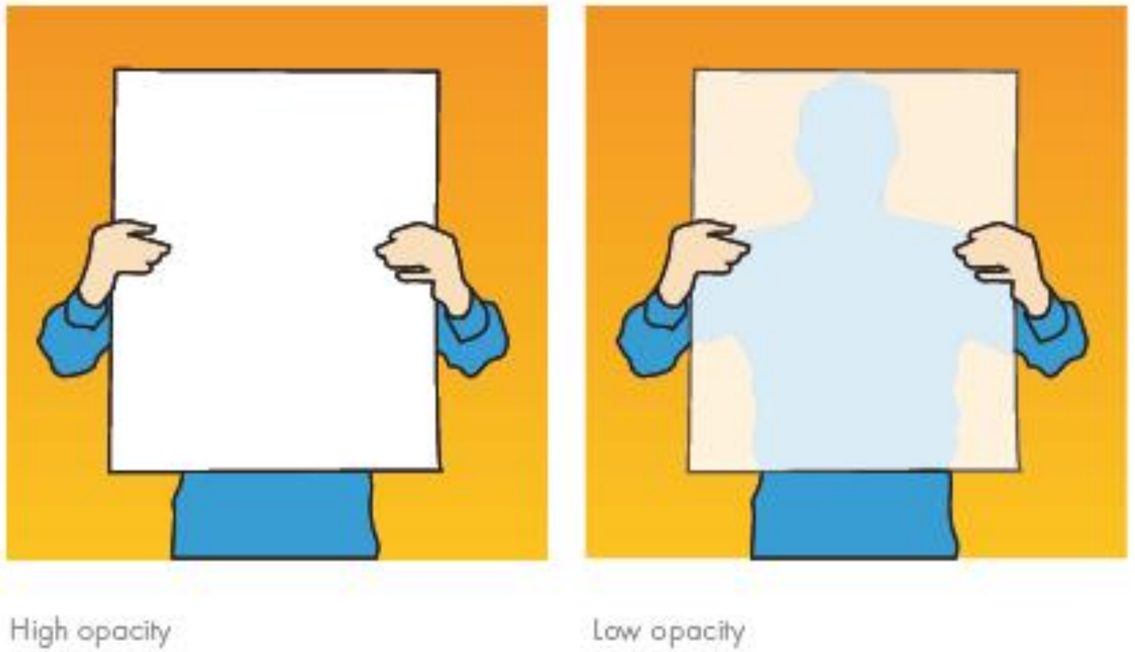
background(red,green,blue,opacity)

We already know the background() function to add a colour to an object.

Example

```
background(220,20);
```

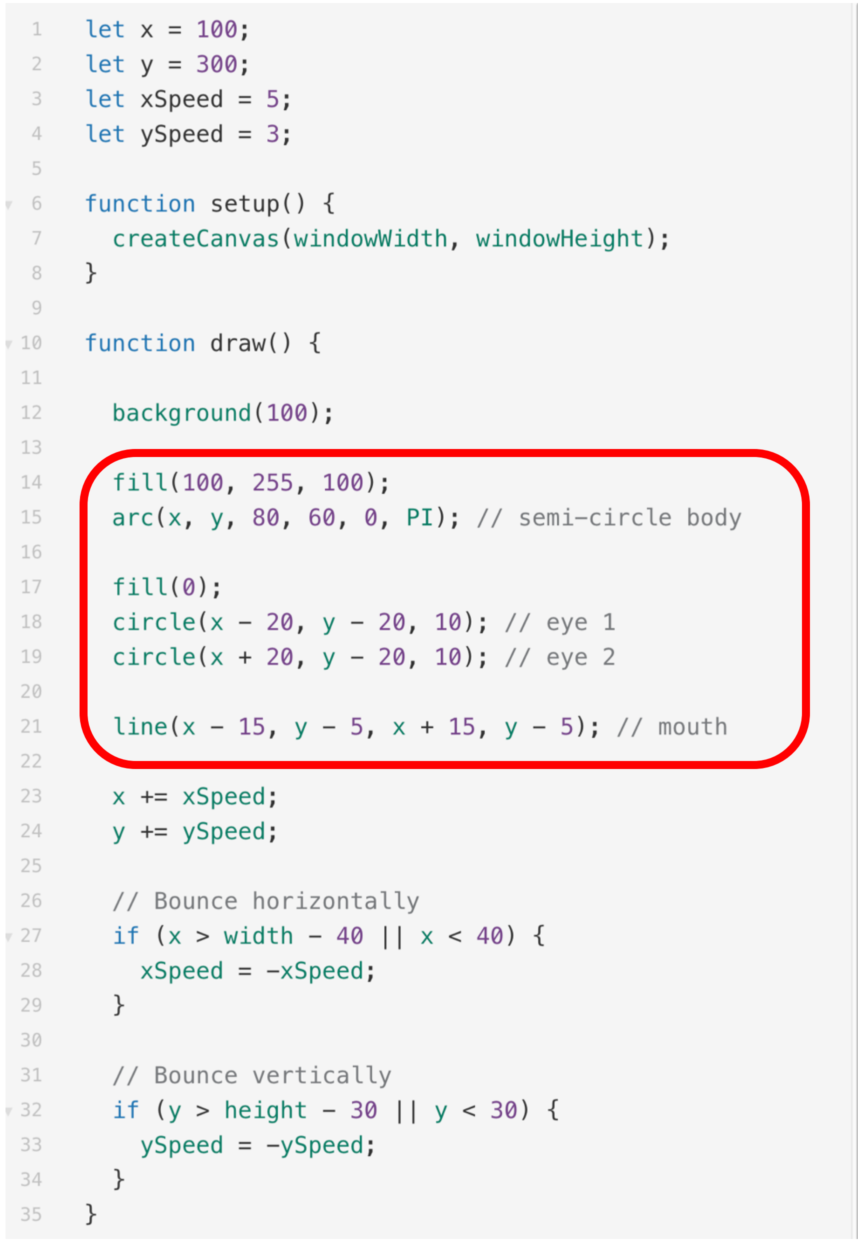
```
background(100,210,120,20);
```



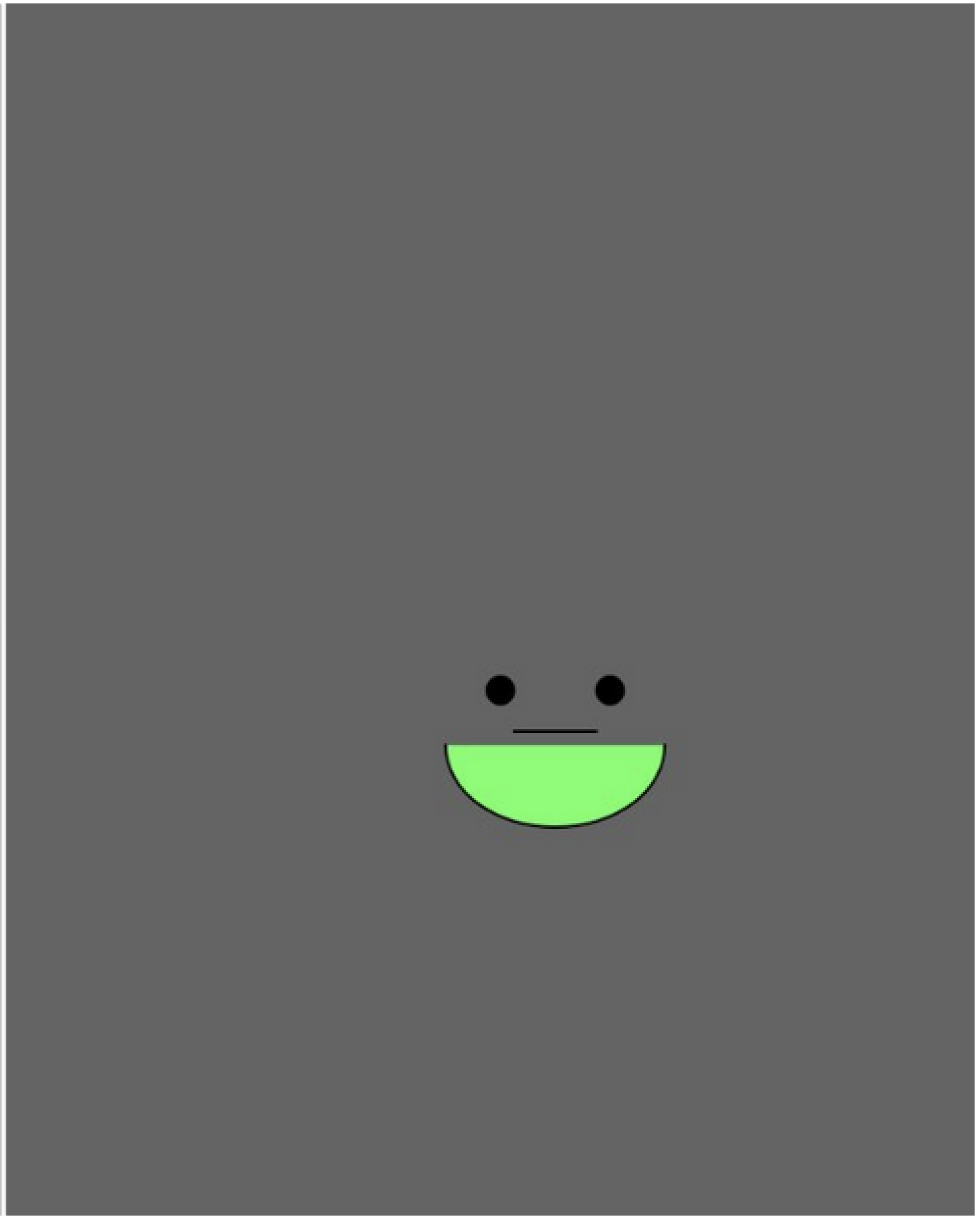
We can add a 2nd or 4th value between 0 (transparent) and 255 (opaque)

Source: https://www.precisecontinental.com/domtar-business-card-basics-1/

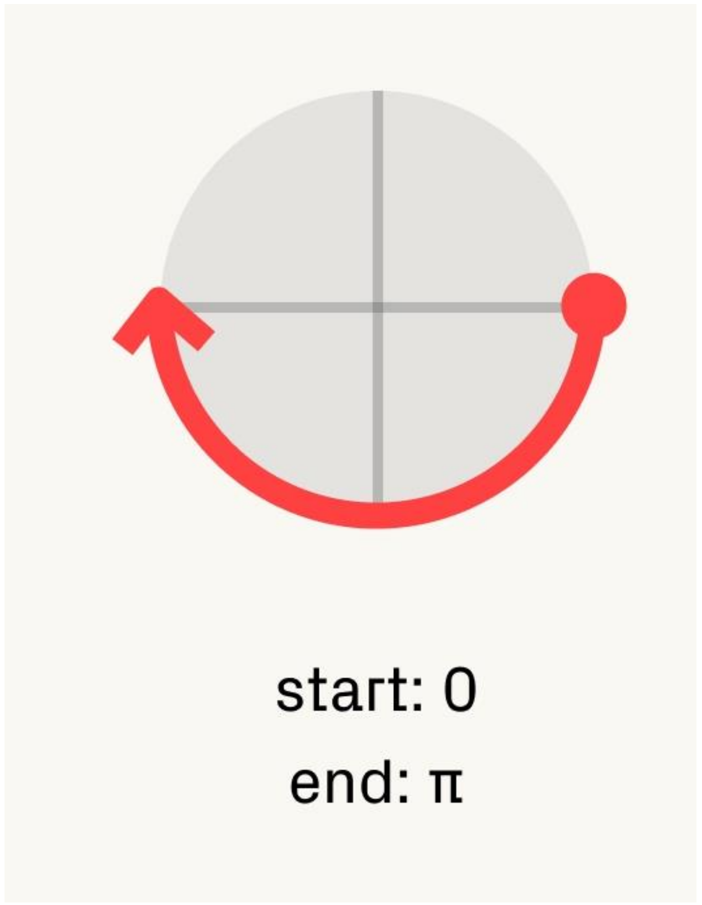
3. 👽 Replace circle with another shape



```
let x = 100;
let y = 300;
let xSpeed = 5;
let ySpeed = 3;

function setup() {
  createCanvas(windowWidth, windowHeight);
}

function draw() {

  background(100);

  fill(100, 255, 100);
  arc(x, y, 80, 60, 0, PI); // semi-circle body

  fill(0);
  circle(x - 20, y - 20, 10); // eye 1
  circle(x + 20, y - 20, 10); // eye 2

  line(x - 15, y - 5, x + 15, y - 5); // mouth

  x += xSpeed;
  y += ySpeed;

  // Bounce horizontally
  if (x > width - 40 || x < 40) {
    xSpeed = -xSpeed;
  }

  // Bounce vertically
  if (y > height - 30 || y < 30) {
    ySpeed = -ySpeed;
  }
}
```



arc()



e.g.

arc(x, y, 80, 60, 0, PI);

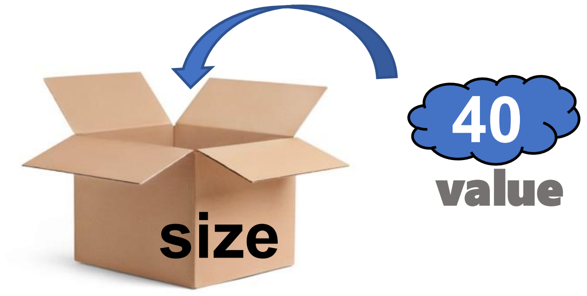
```
arc(x, y, w, h, start, stop, [mode], [detail])
```

Recap

3 ways of using variables

1. Create a Variable:

define name and value at the top of your code



```
let size = 40;
```

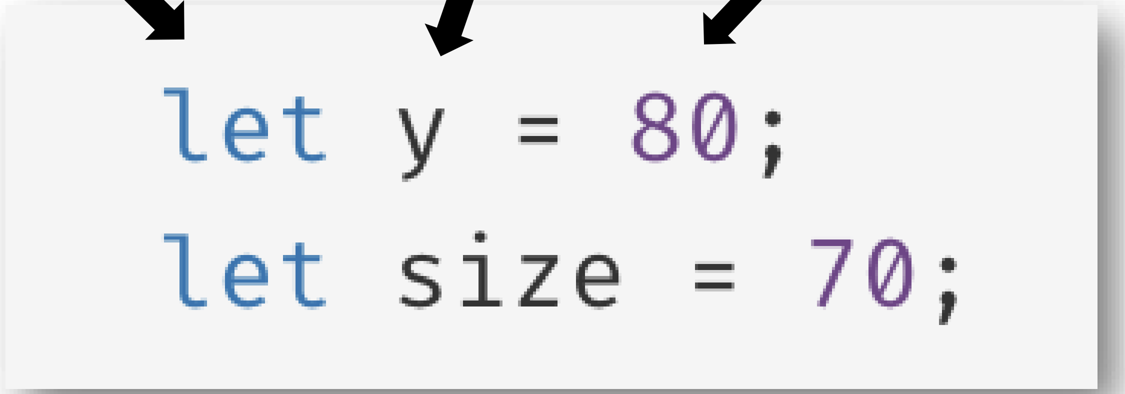
How to create variables

give it a name

let is written so that the computer knows we are creating a new variable

give it a value

This doesn't have to be a number, it could also be letters (string) or true/false.

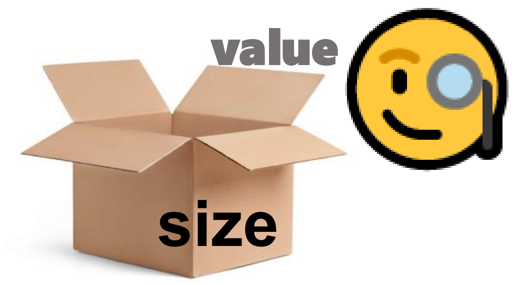


```
let y = 80;
let size = 70;
```

3 ways of using variables

2. Read a Variable:

use the variable to put its value into your code

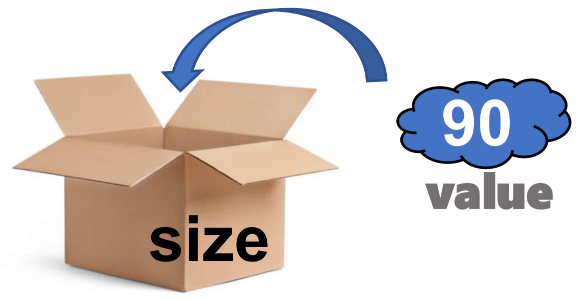


```
circle(100, 80, size);
```

3 ways of using variables

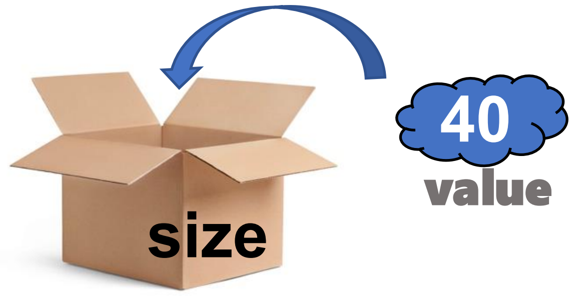
3. Change a Variable:

put a new value into the variable



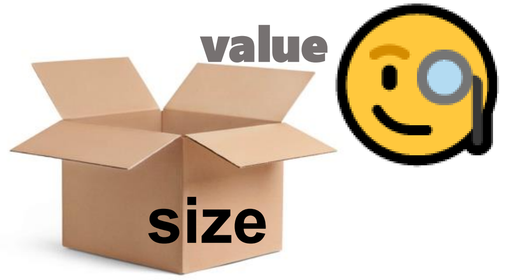
```
size = 90;
```

3 ways of using variables



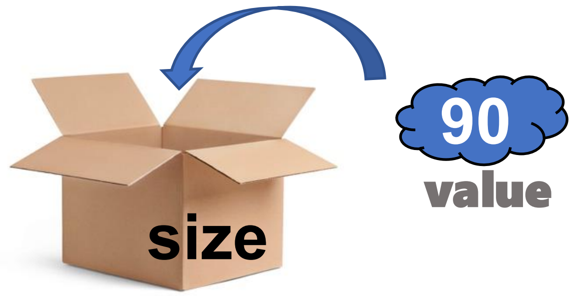
Create define name and value at the top of your code

```
let size = 40;
```



Read Use the variable to put its value into your code

```
circle(100, 80, size);
```



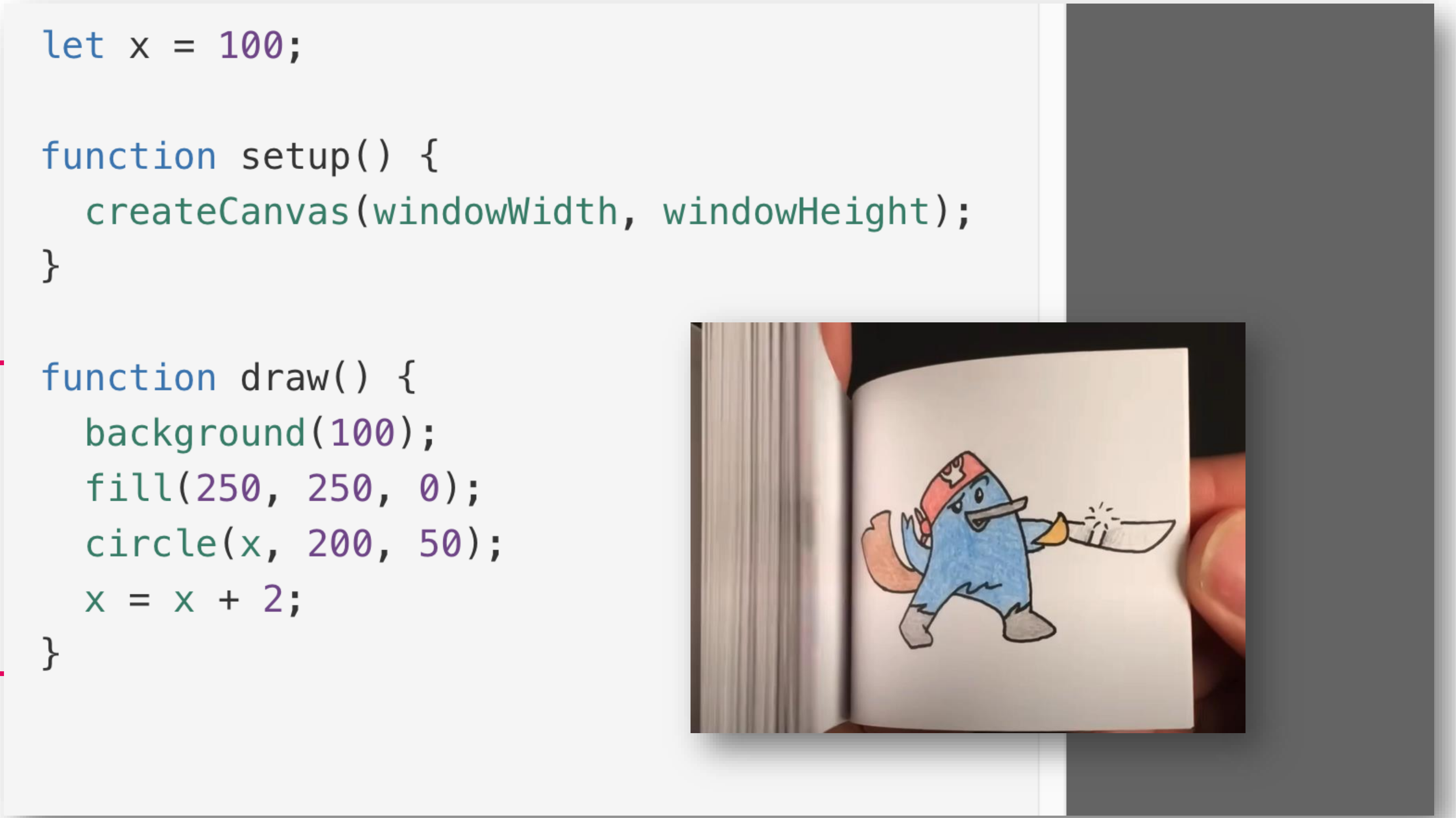
Change Put a new value into the variable

```
size = 90;
```

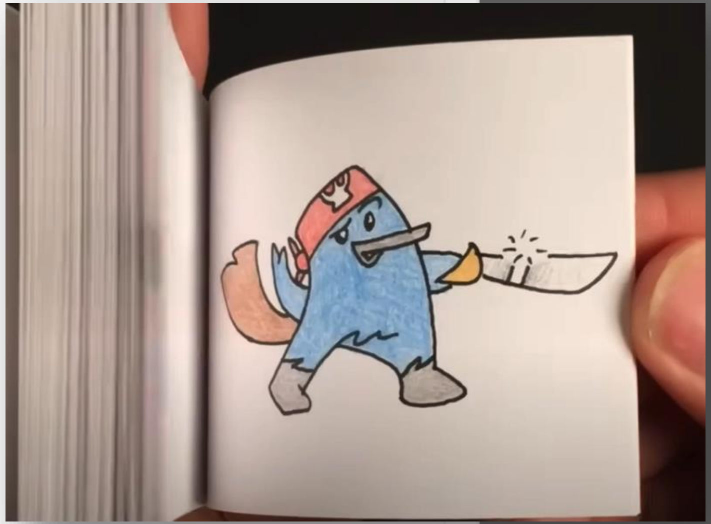
The Magic of draw()

happens only 1x

happens 60x per second

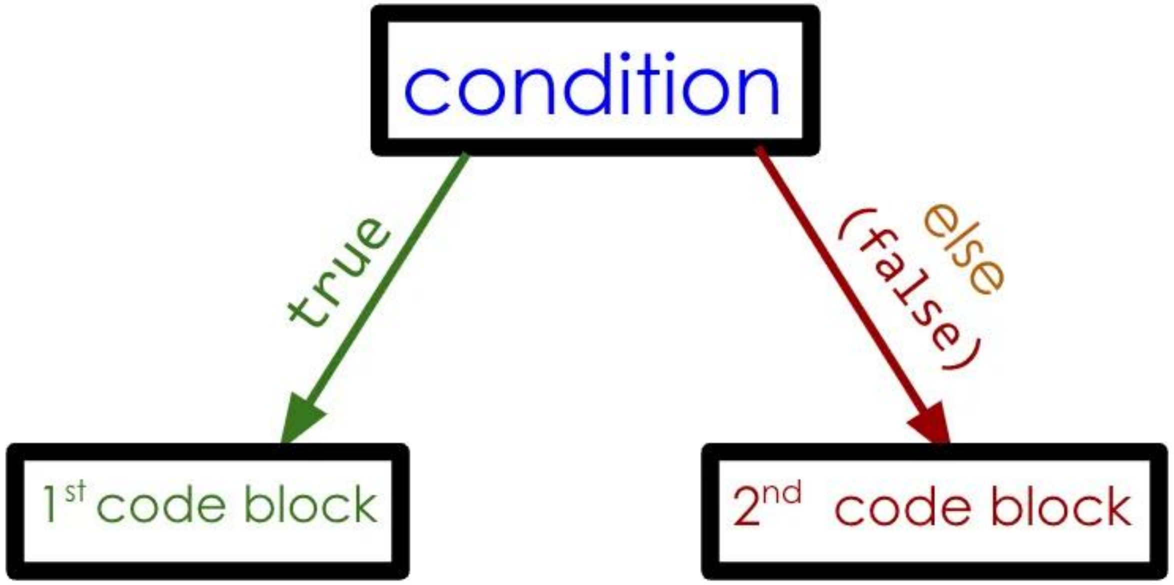


```
let x = 100;

function setup() {
  createCanvas(windowWidth, windowHeight);
}

function draw() {
  background(100);
  fill(250, 250, 0);
  circle(x, 200, 50);
  x = x + 2;
}
```

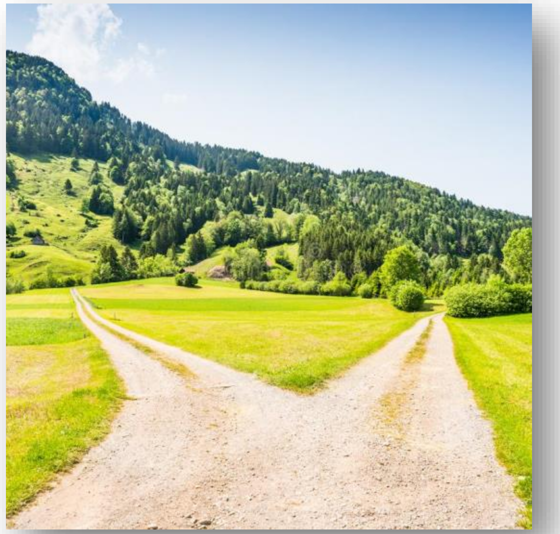


Different paths with *if...else...*

How our programs can follow different paths.



```
if (condition) {
  // code to run if the condition is true
} else {
  // code to run if the condition is false
}
```



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