



# Armstrong

## School Program 2023-2024

### Lesson 6



# Armstrong

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# Lesson Content



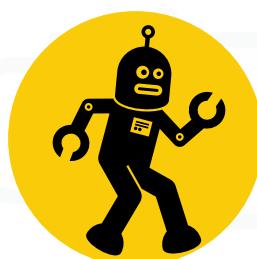
**Revising motor movement**



**Turning the robot**



**Functions**



**Moving the robot**



# Remember

## Setting PWM on mblock



PWM pins 3, 5, 6, 9, 10, 11.



number between 0 and 255



# Remember

## Code to move robot forward with speed

```
when Arduino Uno starts up
  set PWM 9 output as 70
  set PWM 11 output as 70
  set PWM 6 output as 70
  set PWM 10 output as 70

forever
  set digital pin 19 output as high ▾
  set digital pin 8 output as low ▾
  set digital pin 20 output as high ▾
  set digital pin 13 output as low ▾
  set digital pin 18 output as high ▾
  set digital pin 7 output as low ▾
  set digital pin 21 output as high ▾
  set digital pin 12 output as low ▾
```

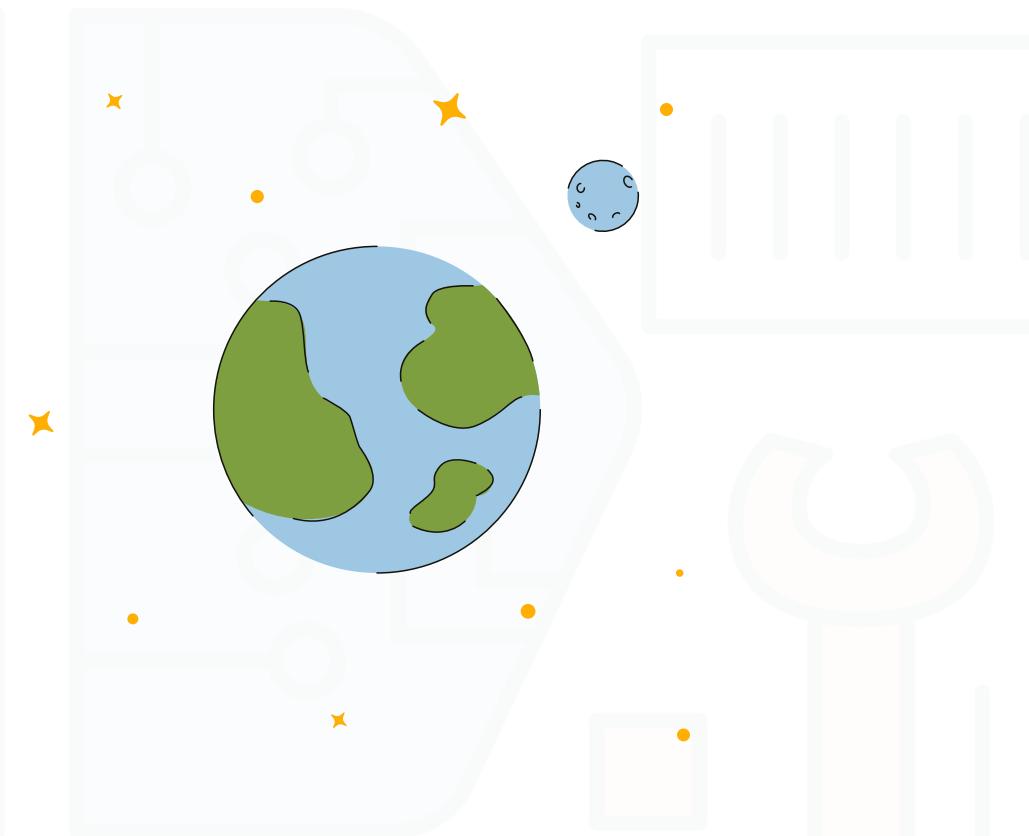
# Rotation

**What is rotation?**

It is a circular motion about an axis or center and this center is called axis of rotation.

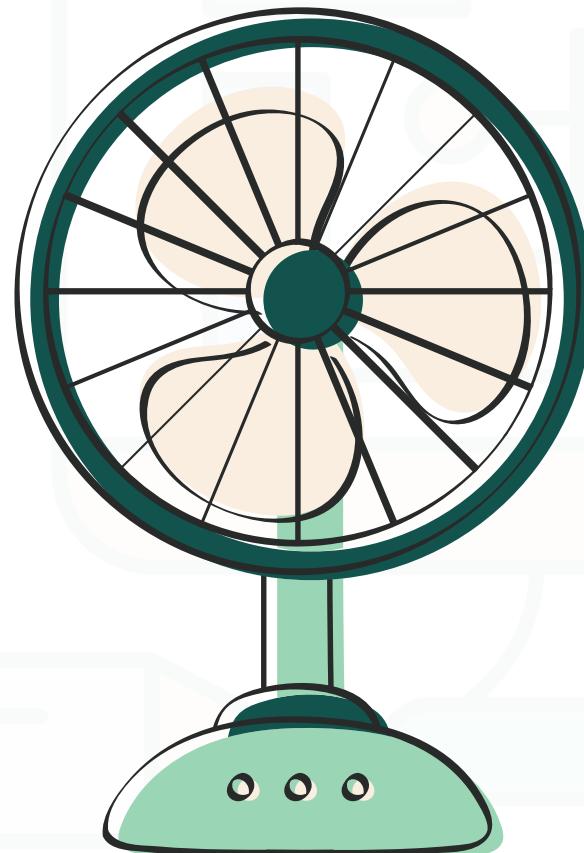
**How do we rotate?**

Depending on the axis of rotation a force is applied to the moving body.

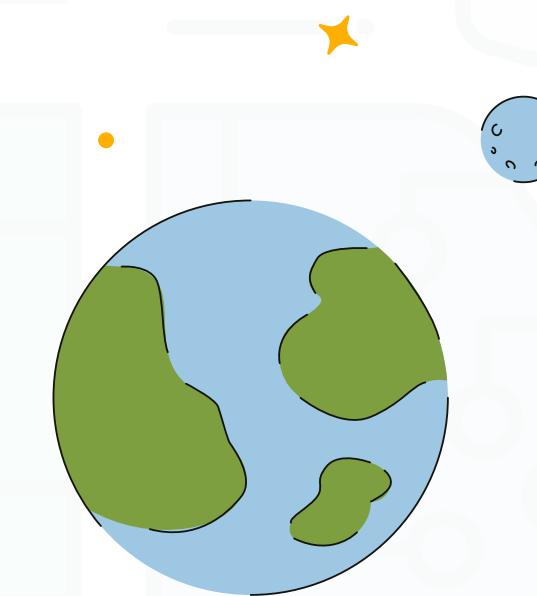


# Axis of Rotation

Object's Center

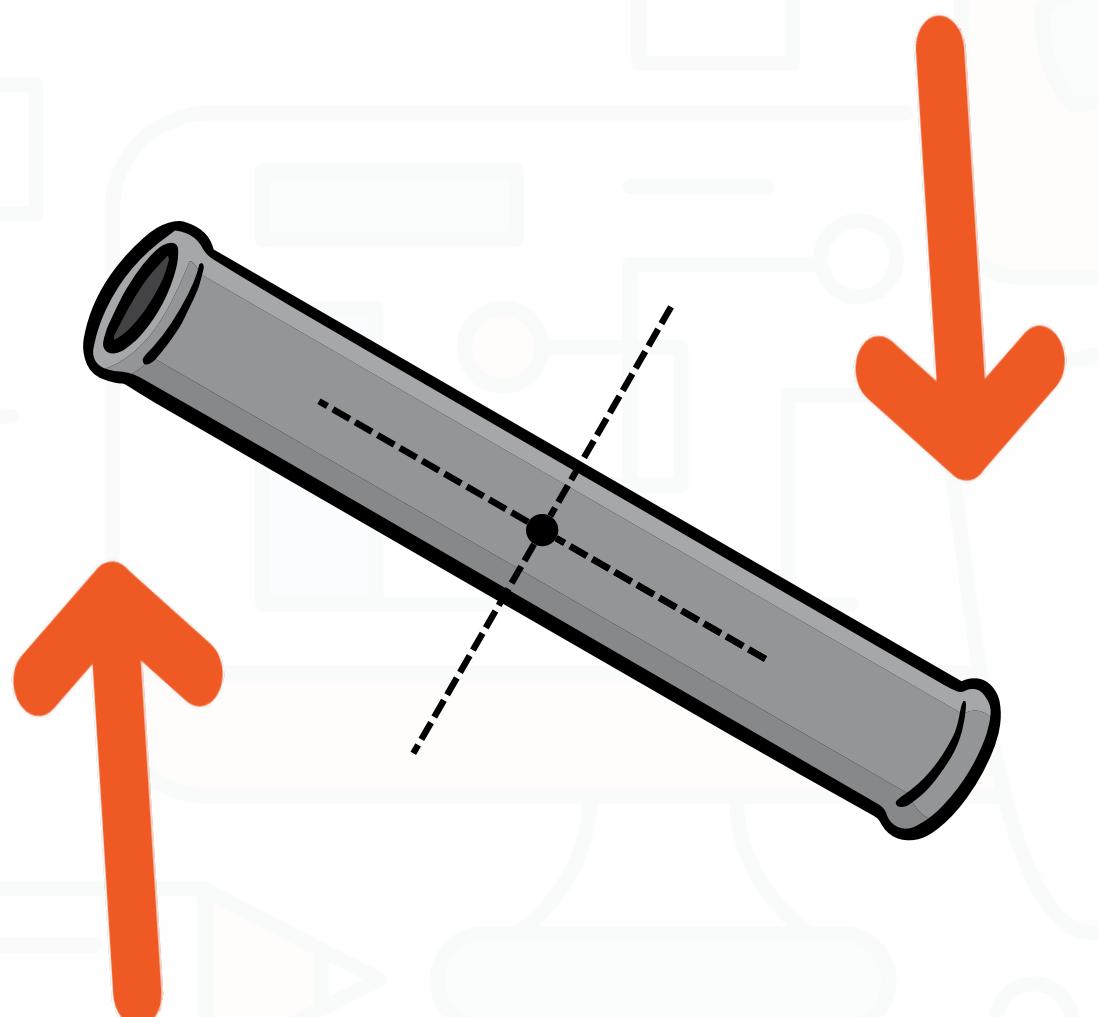


Point Outside The  
Objects Body

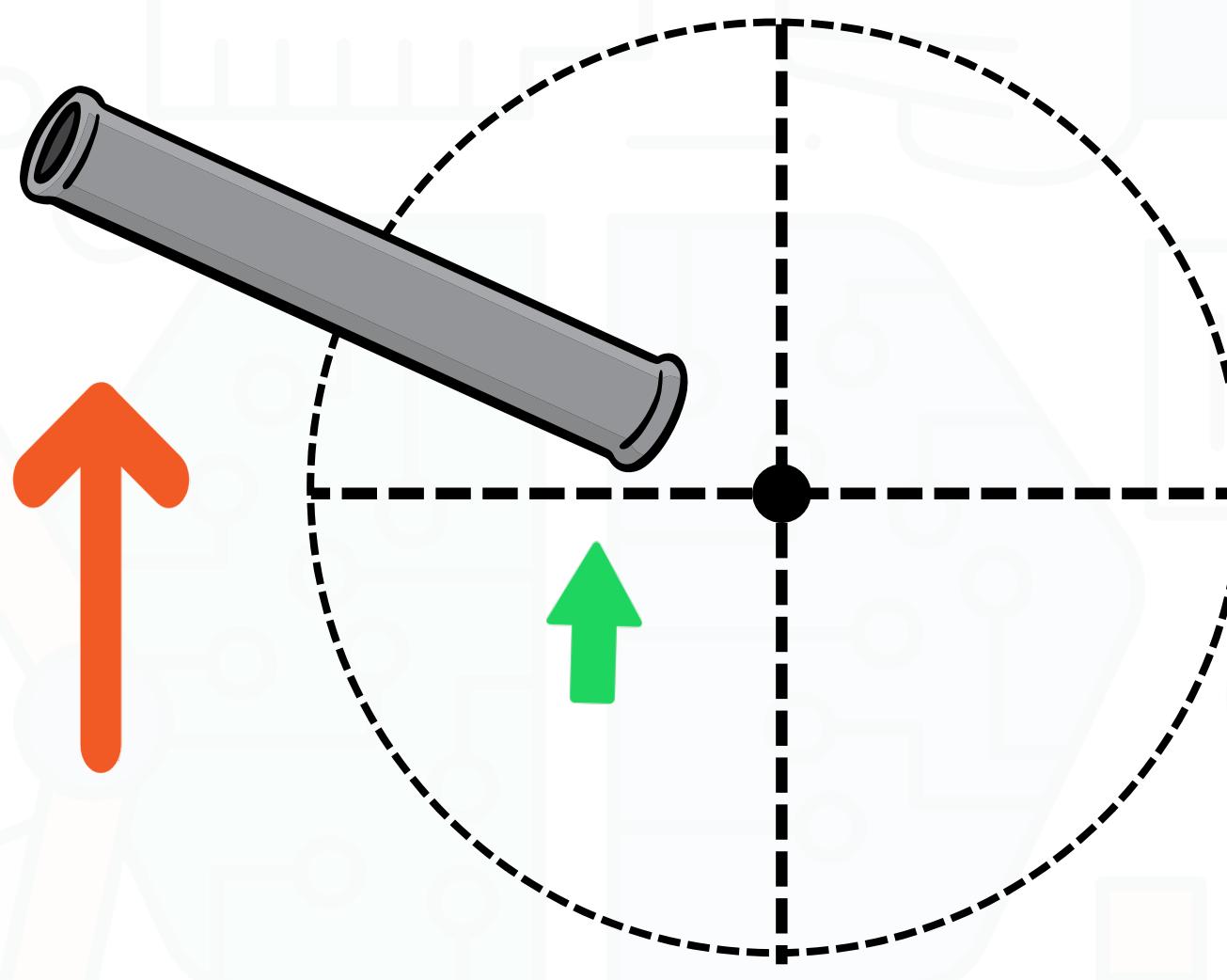


# Axis of Rotation

Object's Center



Point Outside The  
Objects Body



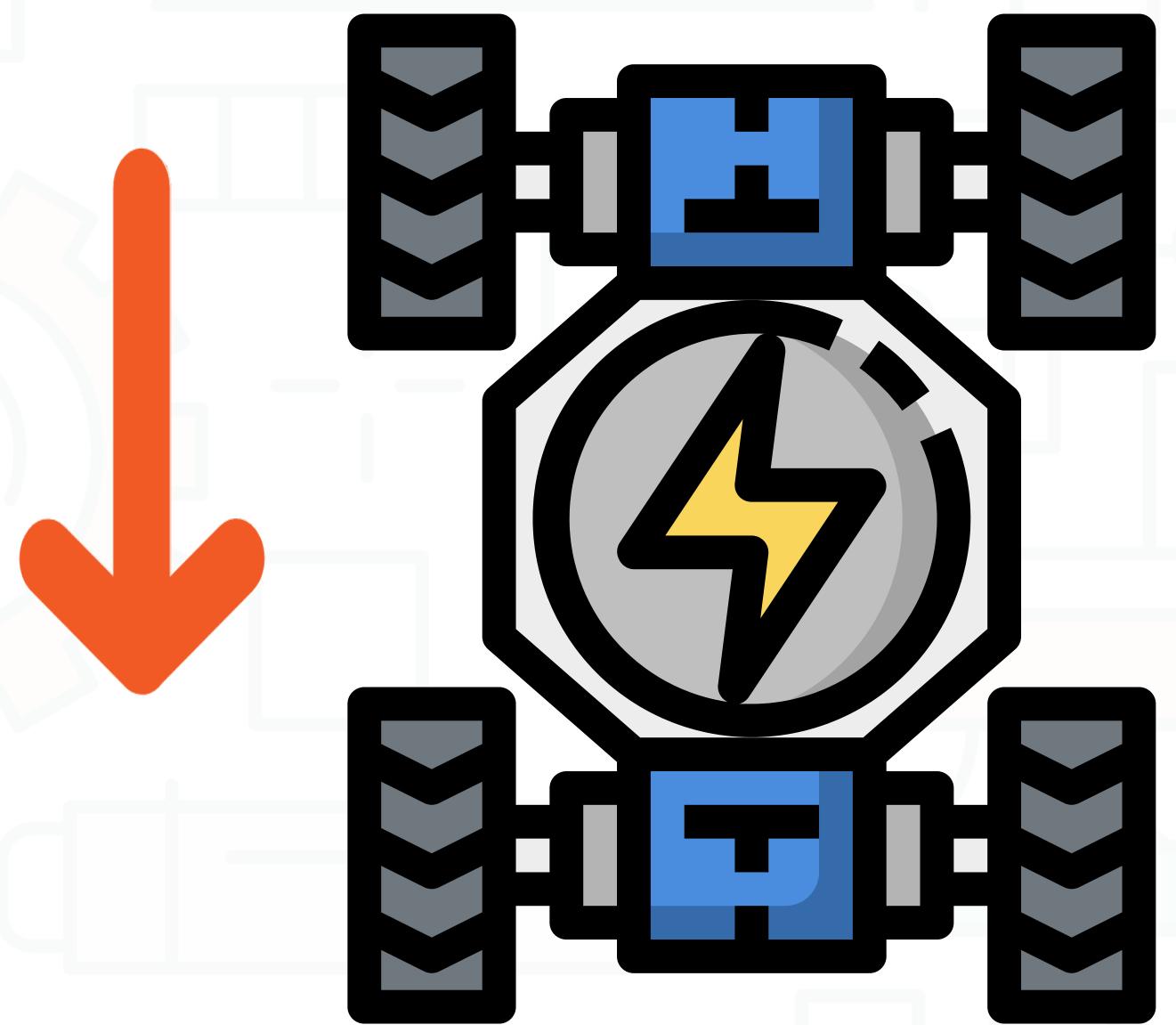
# Think

How can we make the robot rotate about its center?

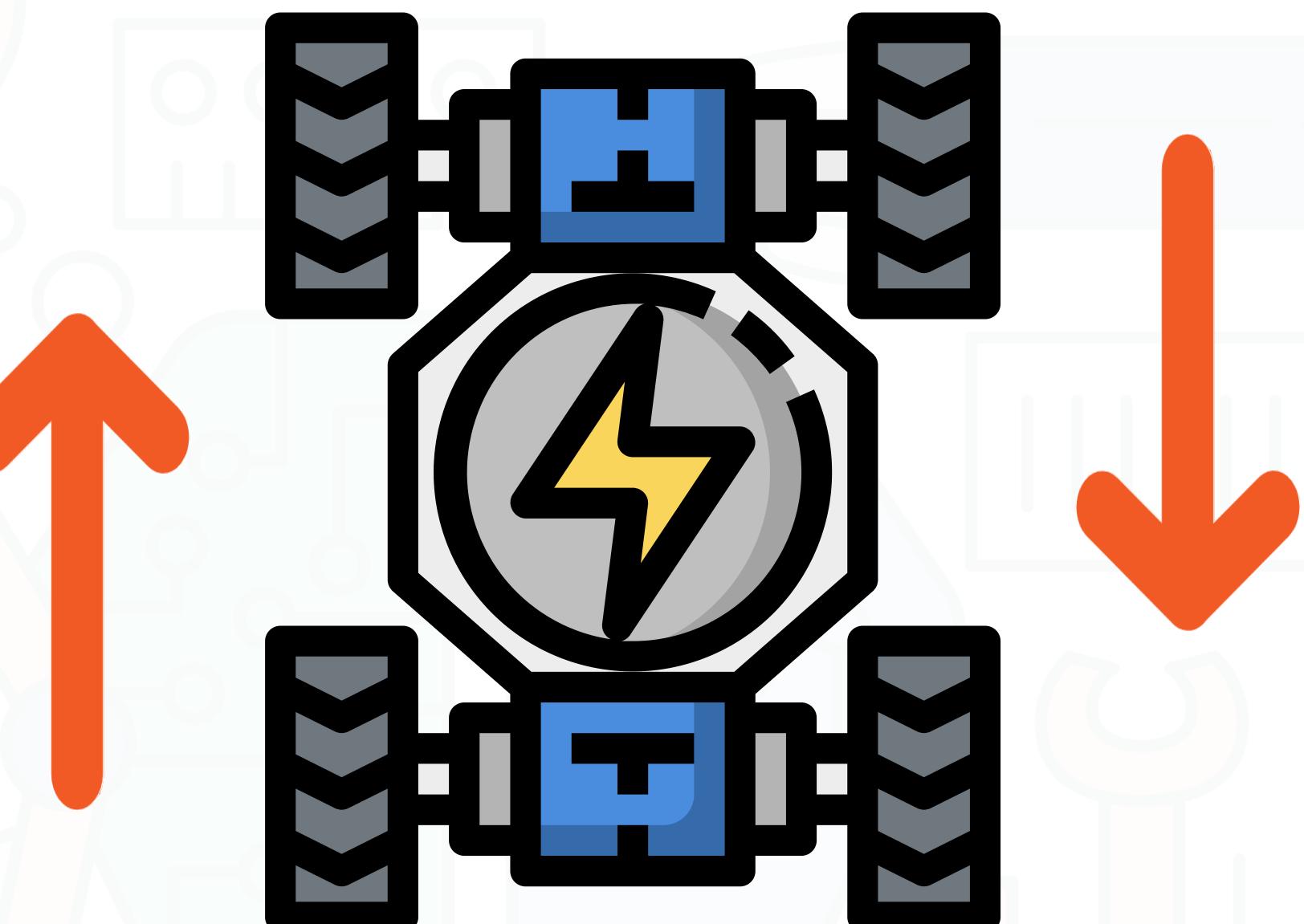


# Rotate The Robot

Left Rotation



Right Rotation



# Let's try it on mBlock



Write a code to rotate the robot about its center.

Try it by yourself



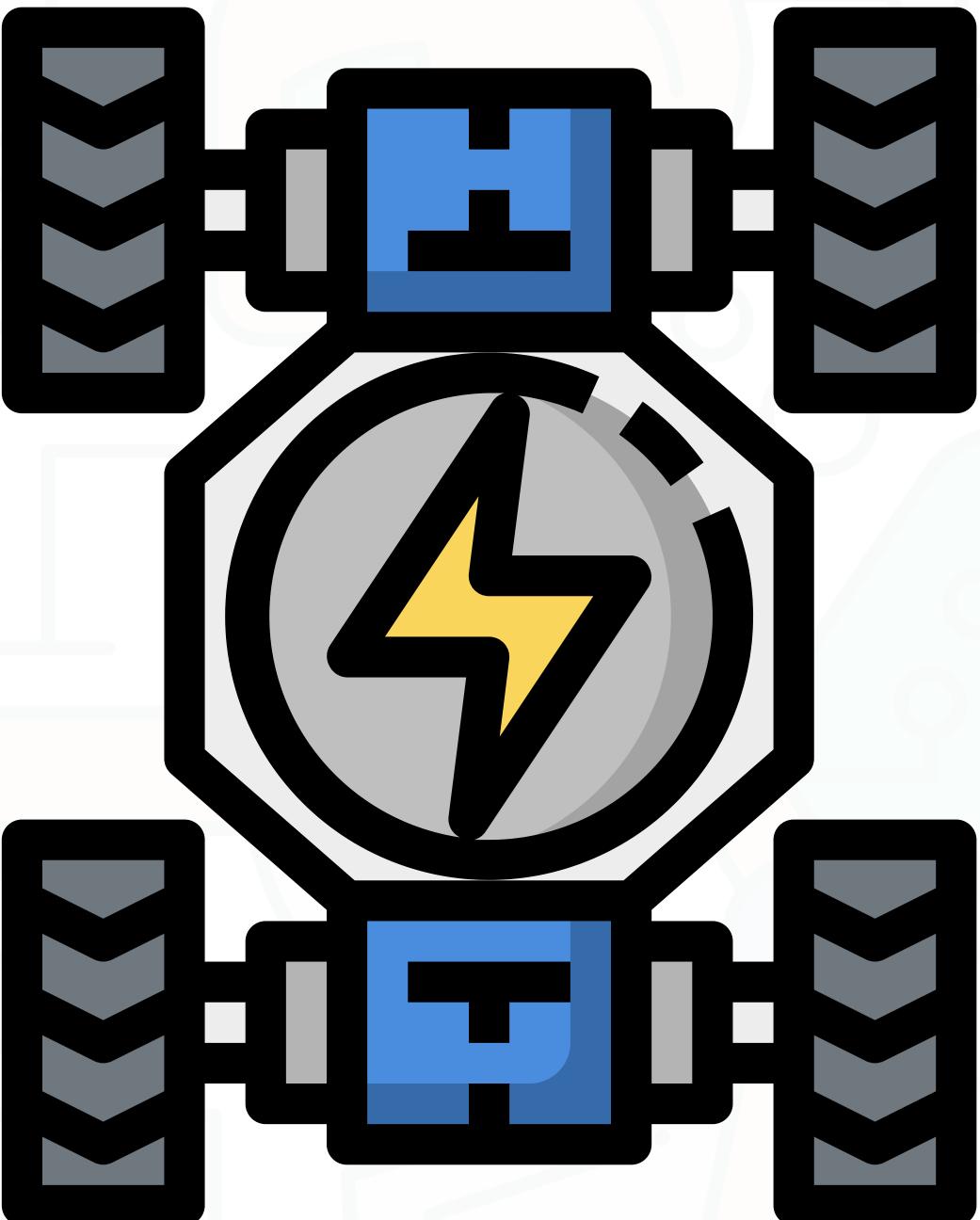
Hint: Remember forward and backward codes.



# Rotate The Robot

## Left Rotation

- Enable -> D6
- Input 1 -> D11
- Input2 -> D12



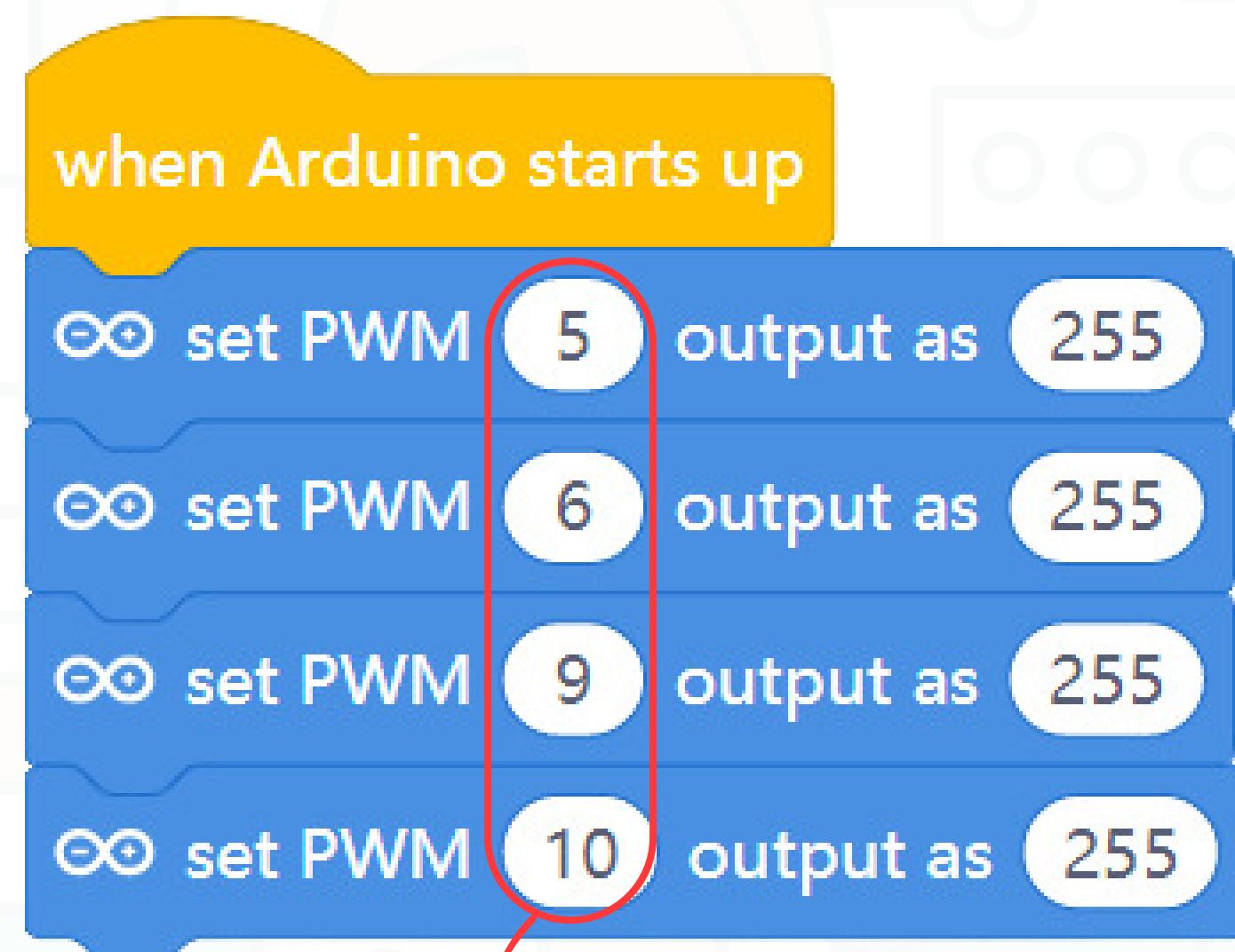
- Enable -> D5
- Input 1 -> D7
- Input2 -> D8

- Enable -> D10
- Input 1 -> A1(D15)
- Input2 -> A2(D16)

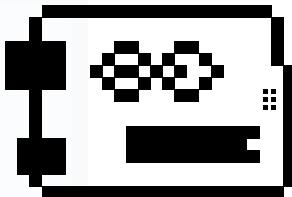
- Enable -> D9
- Input 1 -> D13
- Input2 -> A0(D14)

# Let's rotate the robot

## Step 1: Set motors' speed

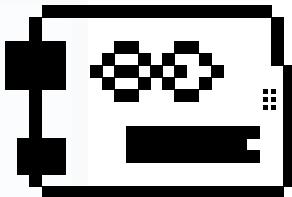
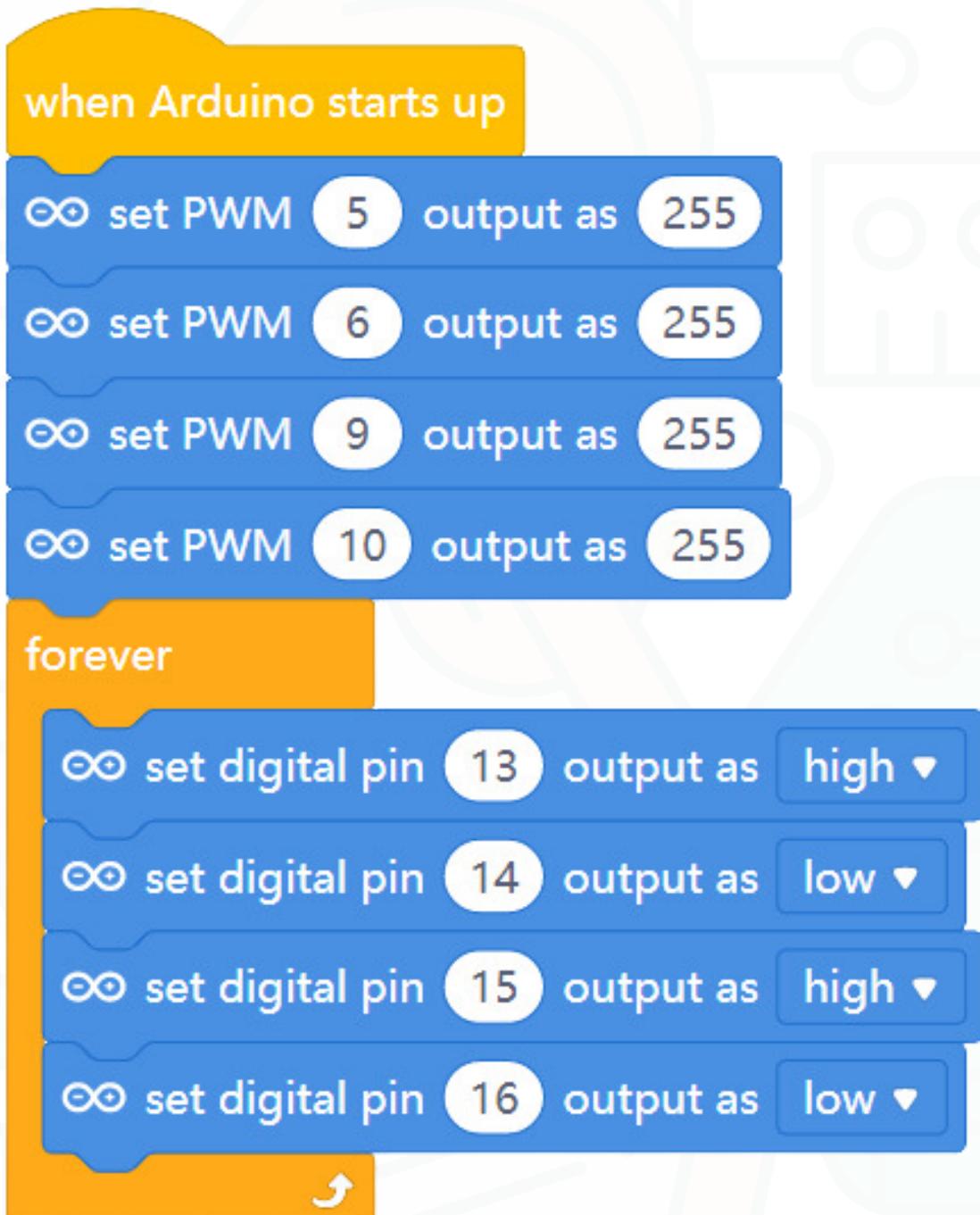


PWM pins



# Let's rotate the robot

## Step 2: Move the right wheels forward



# Let's rotate the robot

## Step 3: Move the left wheels backward



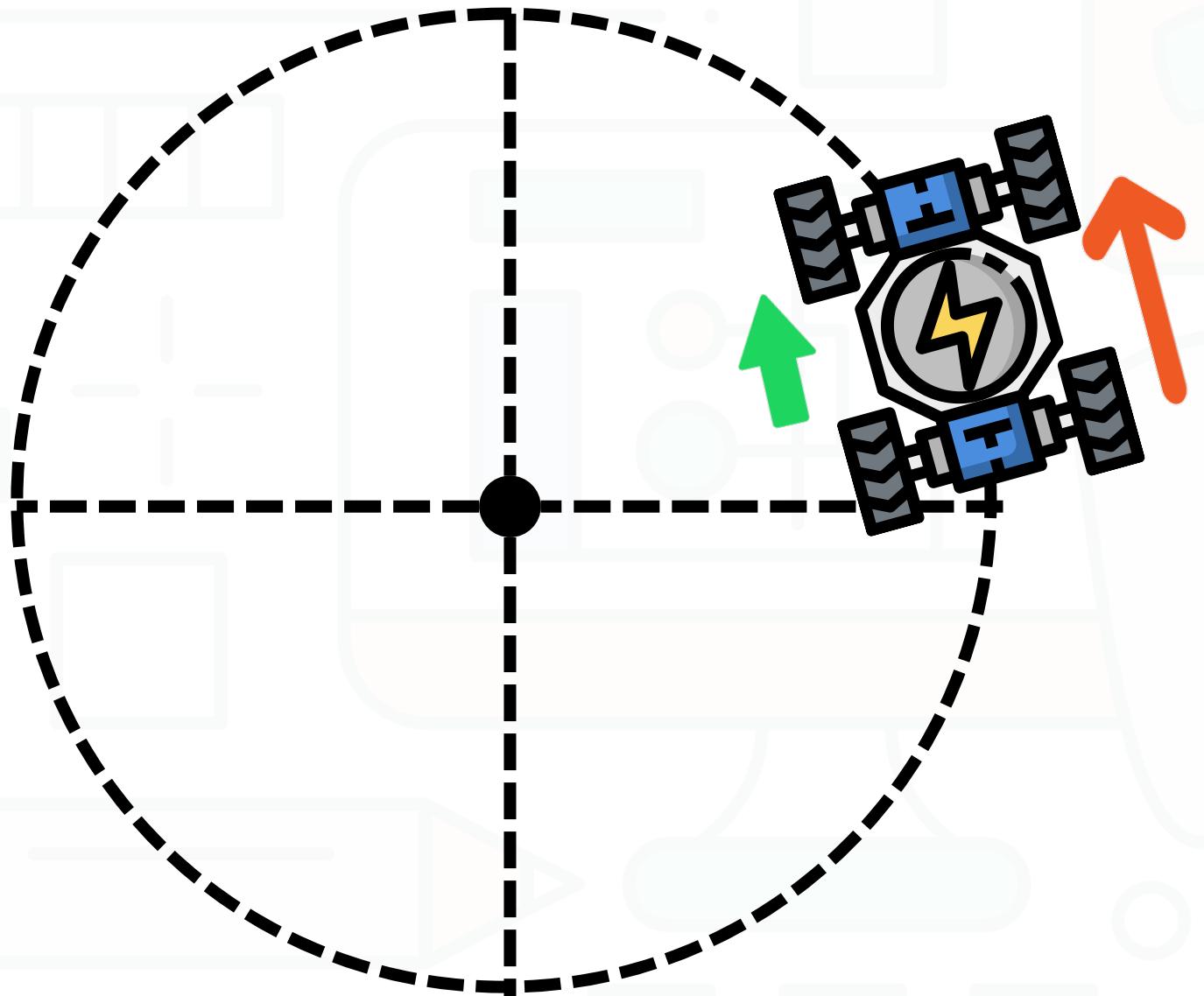
# Think

How can we make the robot rotate around an object?

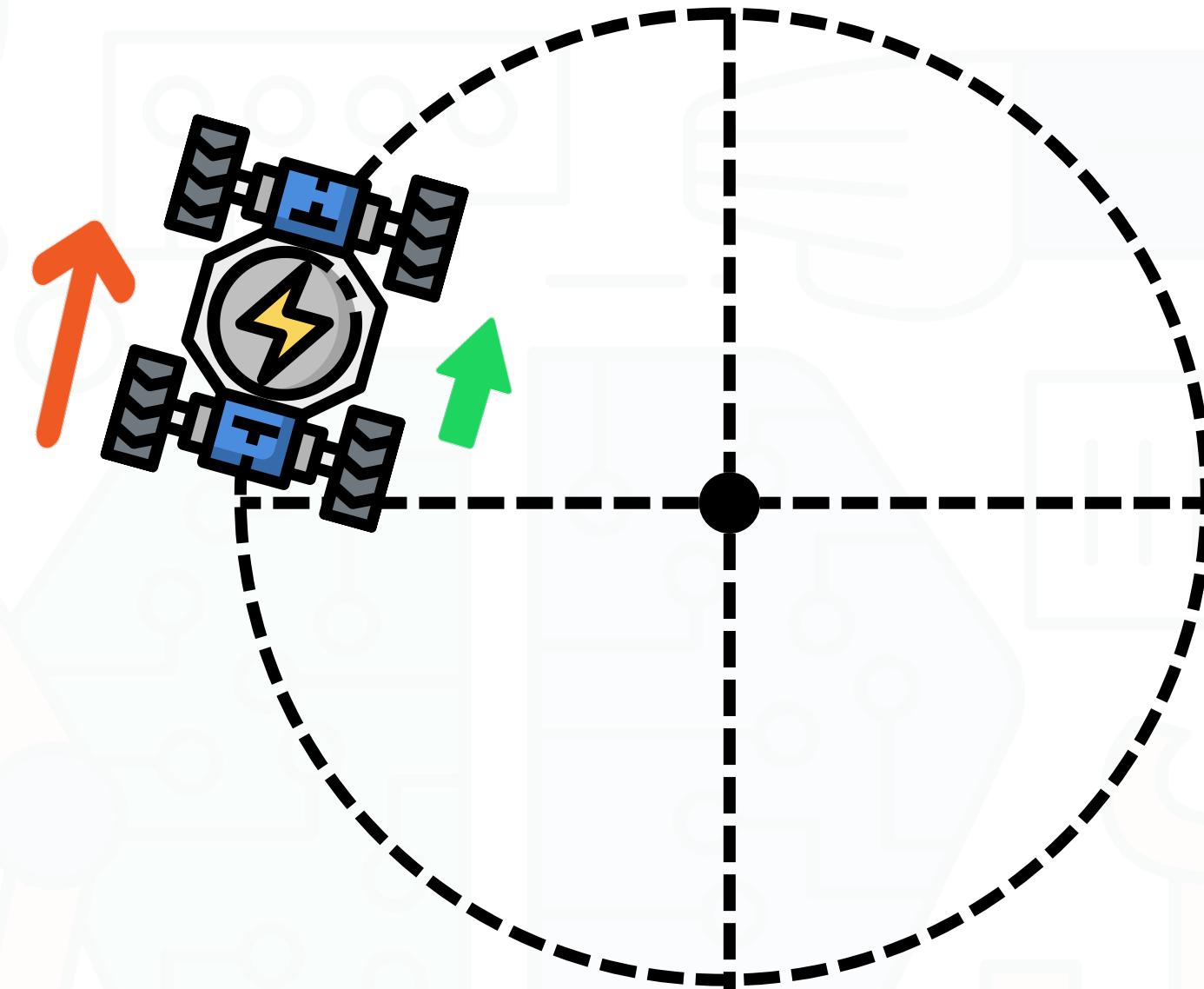


# Rotate The Robot

Left Curve Forward

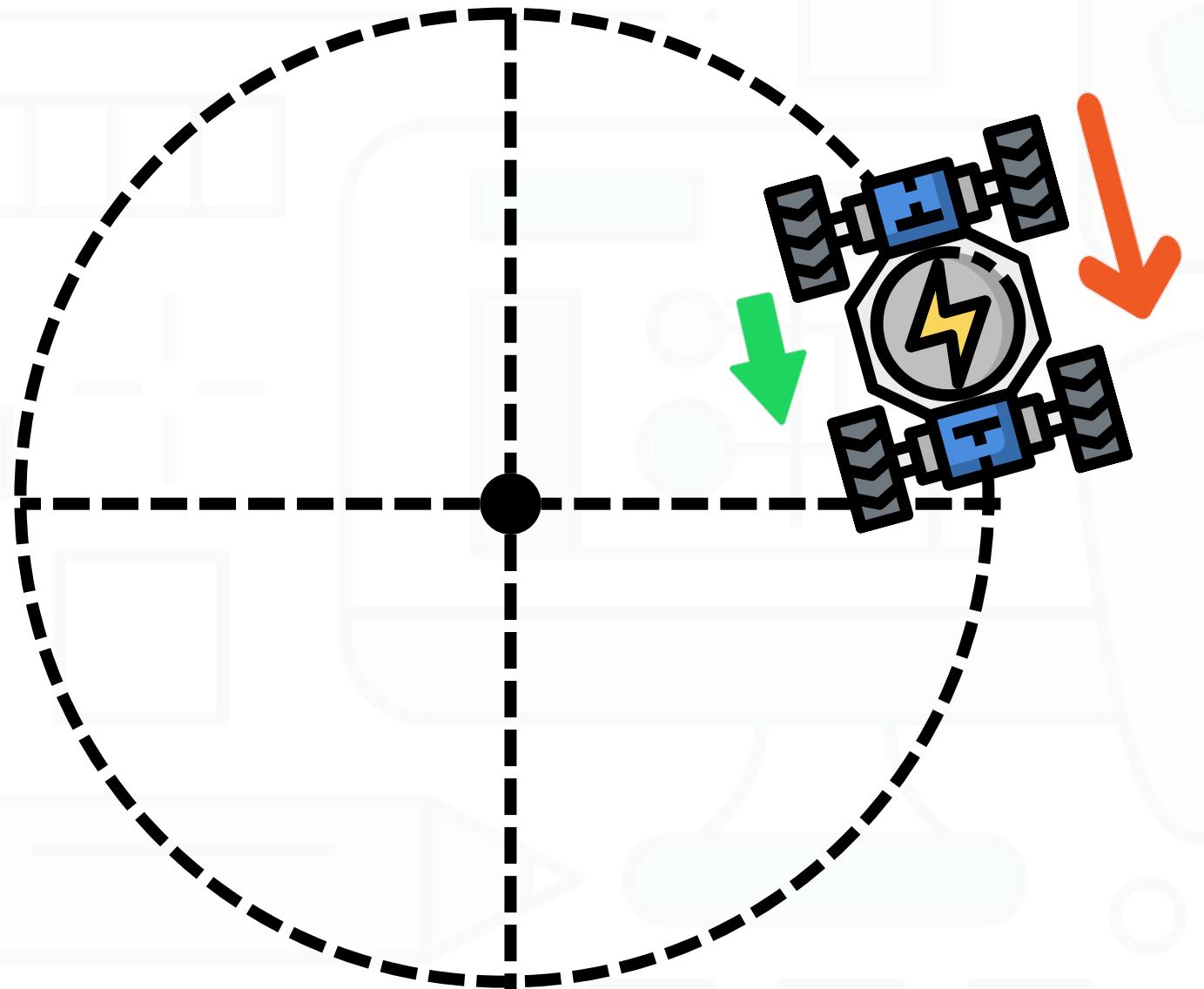


Right Curve Forward

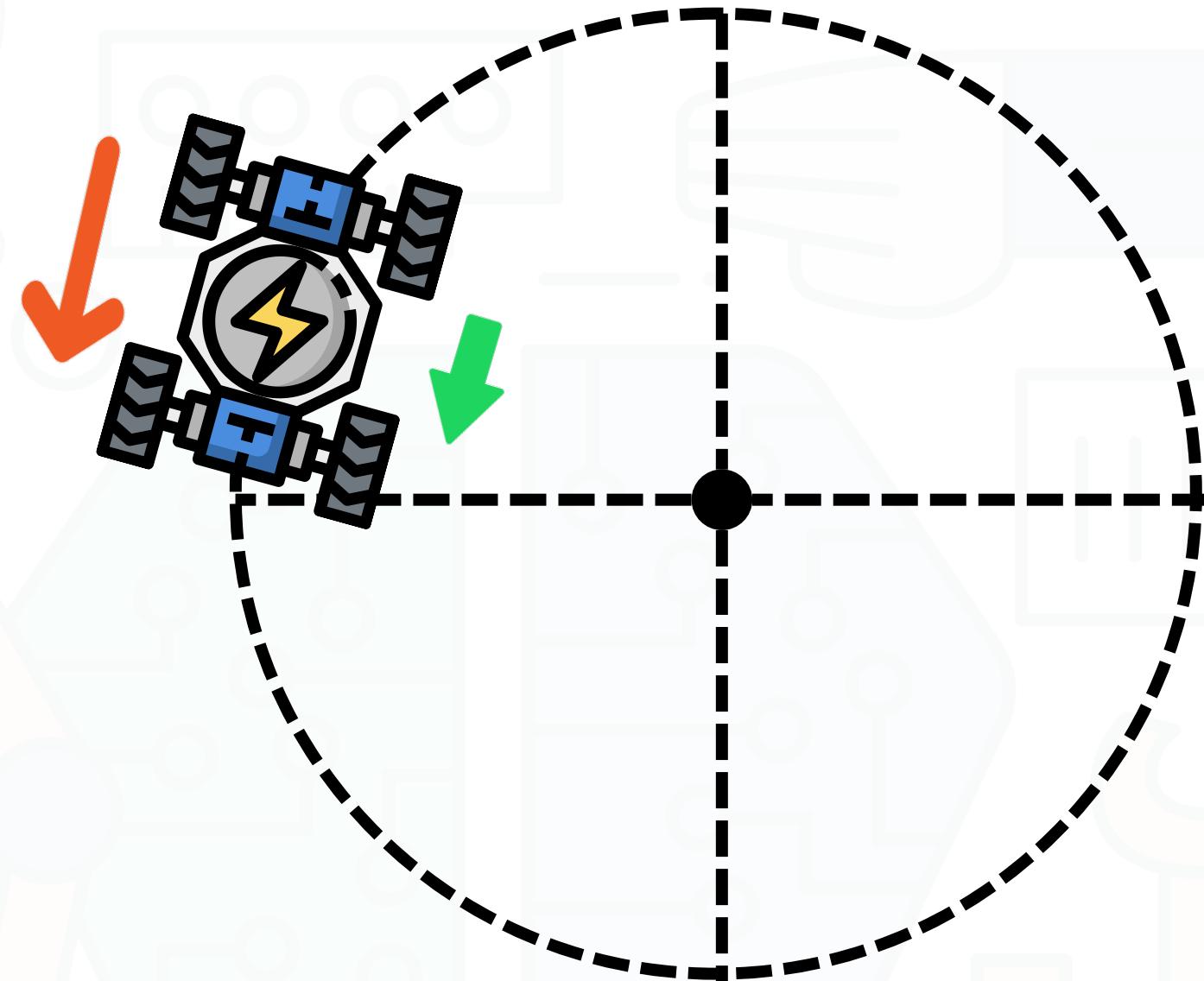


# Rotate The Robot

Left Curve Backward



Right Curve Backward



# Let's try it on mBlock

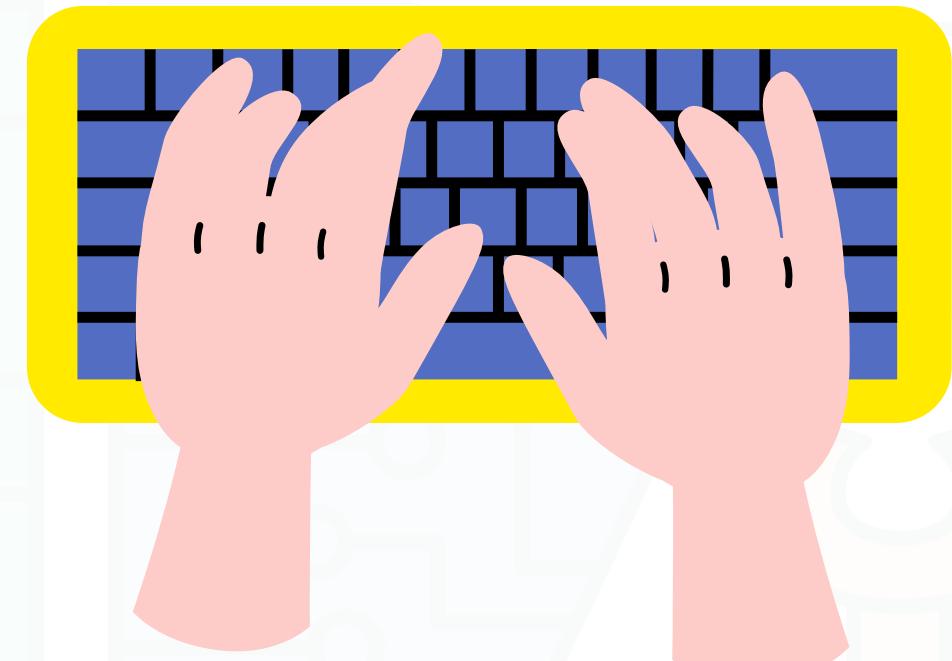


Write a code to rotate the robot about its center.

Try it by yourself

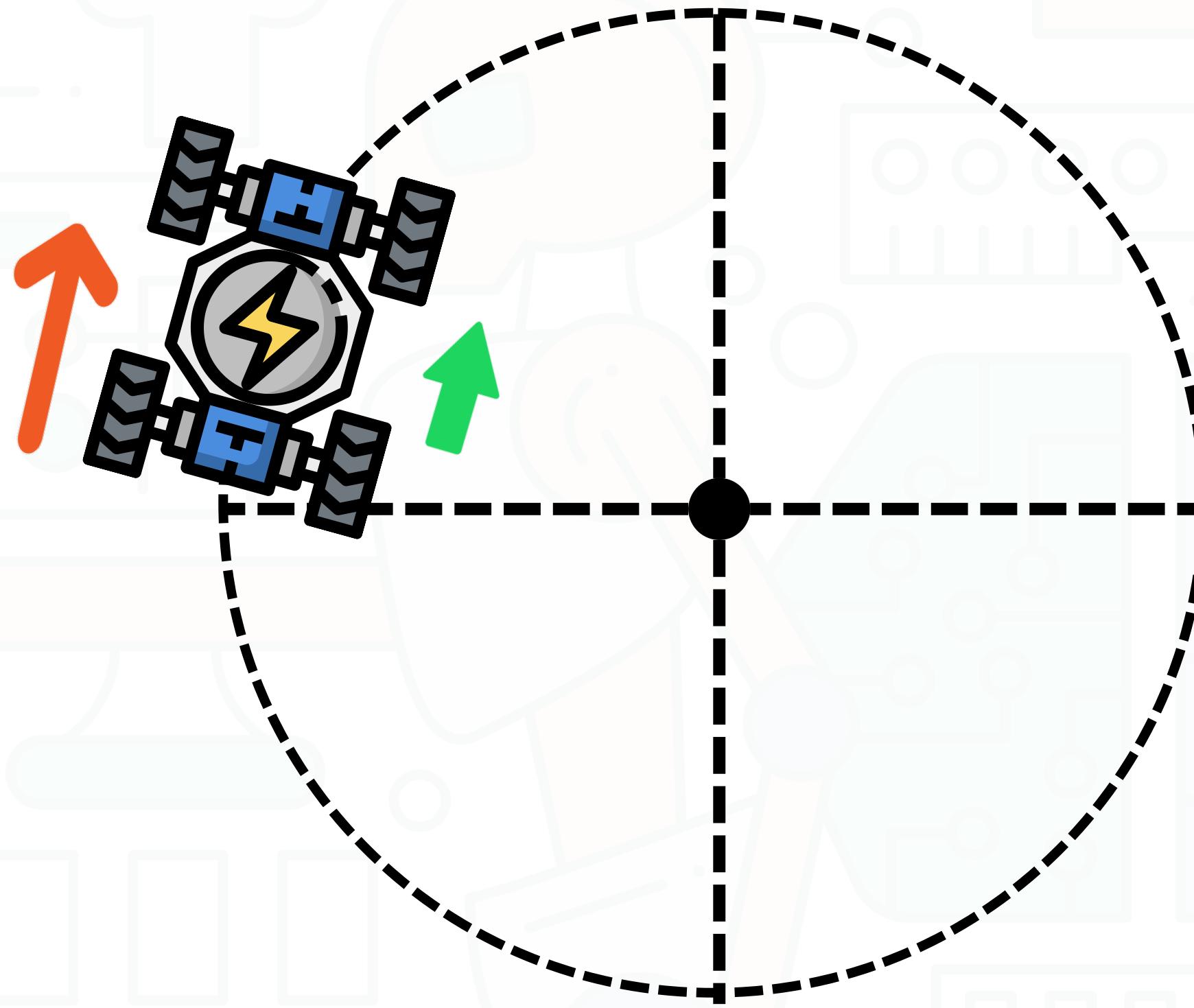


Hint: Use PWM to set speed.



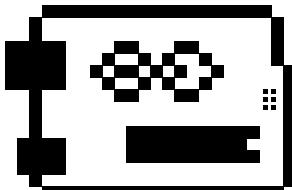
# Rotate The Robot

Right Rotation



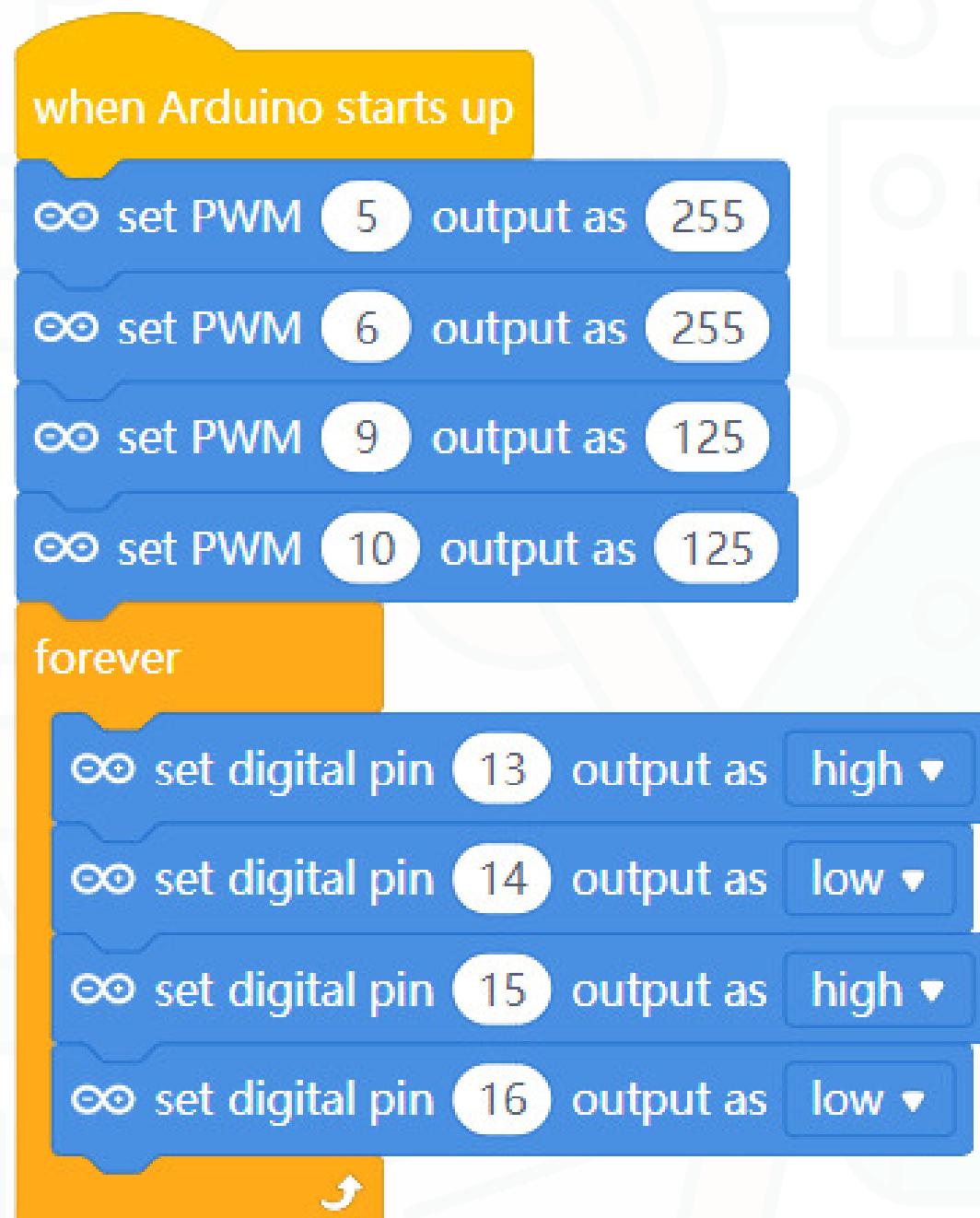
# Let's rotate the robot

## Step 1: Set motors' speed



# Let's rotate the robot

## Step 2: Moving the right wheels forward



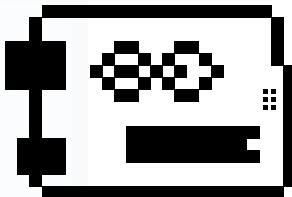
A Scratch script consisting of two main sections: "when Arduino starts up" and "forever".

**when Arduino starts up:**

- set PWM 5 output as 255
- set PWM 6 output as 255
- set PWM 9 output as 125
- set PWM 10 output as 125

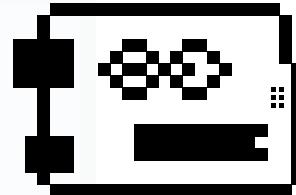
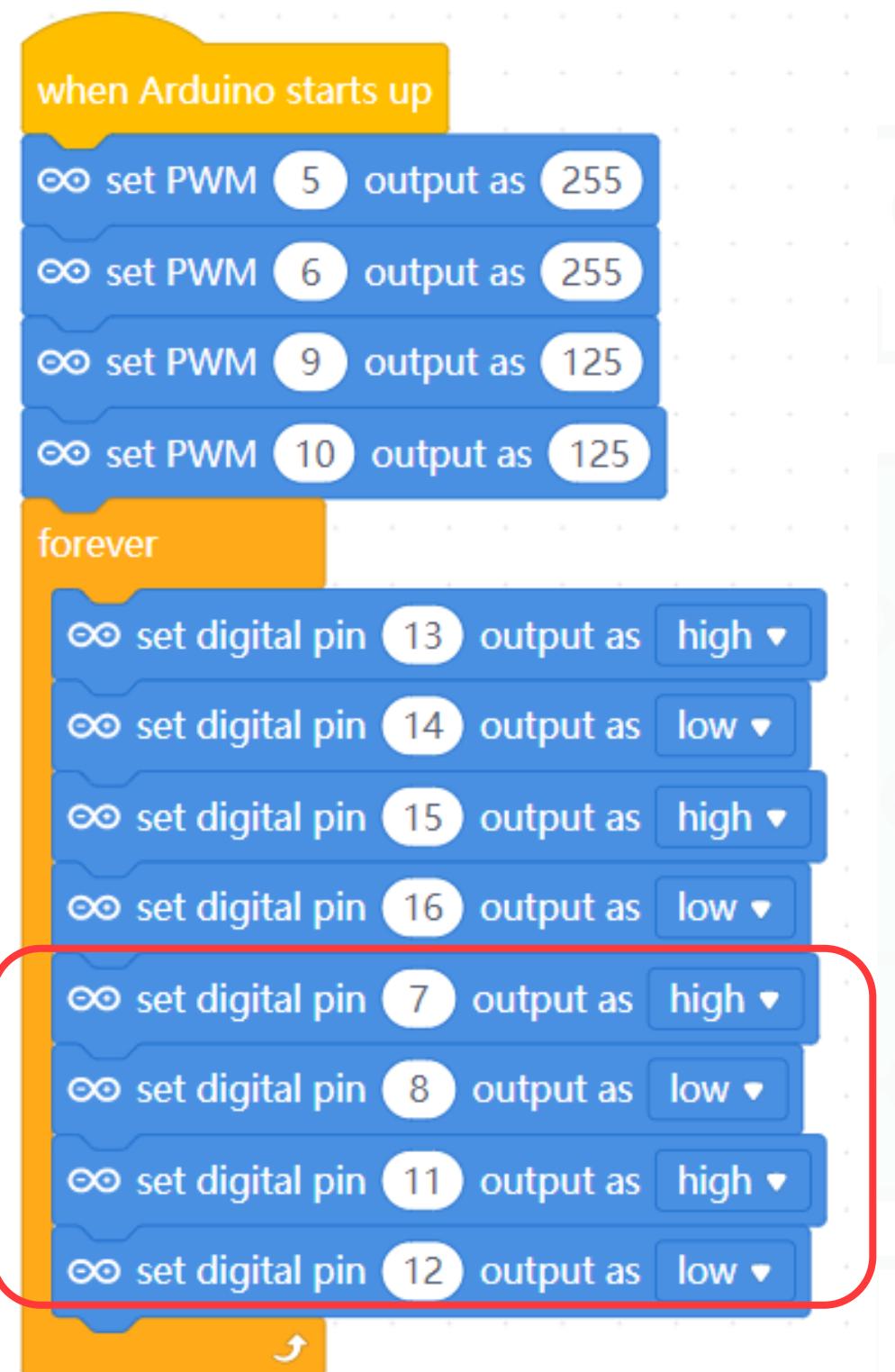
**forever:**

- set digital pin 13 output as high
- set digital pin 14 output as low
- set digital pin 15 output as high
- set digital pin 16 output as low



# Let's rotate the robot

## Step 3: Moving the left wheels forward



# Think

## What are functions?



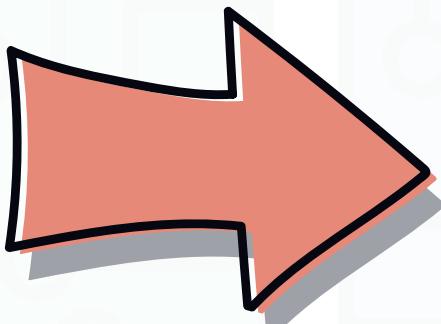
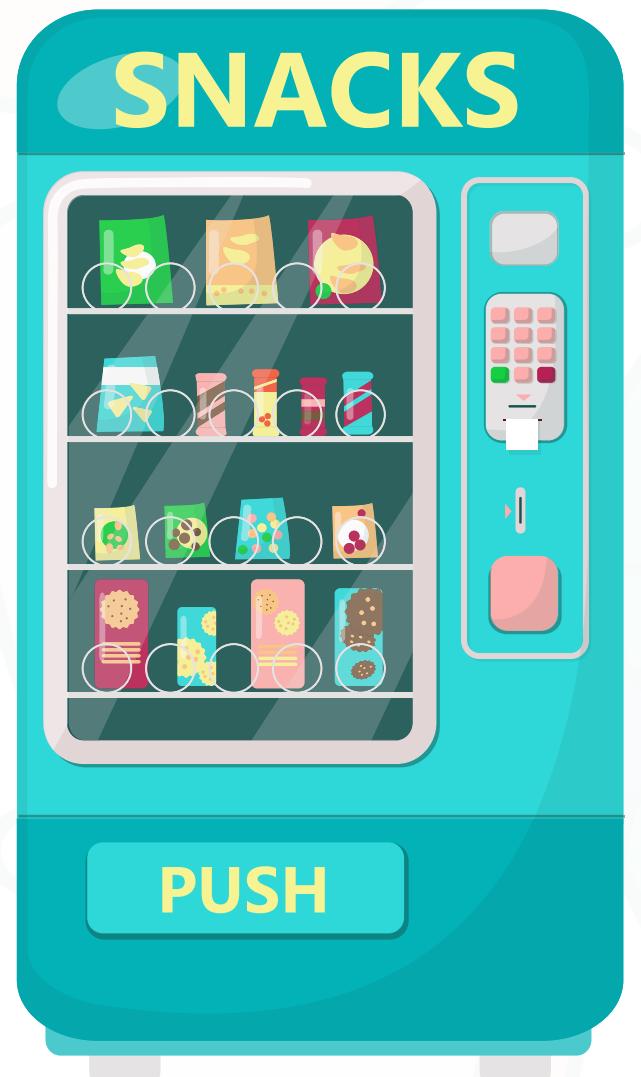
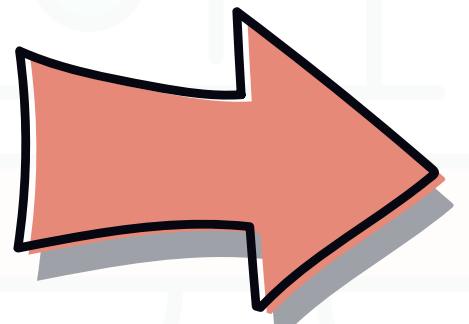
# Functions

What is a function?

A group of actions that takes an input and produces an output



Input



Output

# Analogy

Imagine you have a cake recipe that mixes the ingredients and puts the mix in the oven.

What will be the output if we used eggs, flour, sugar and strawberries as the ingredients?

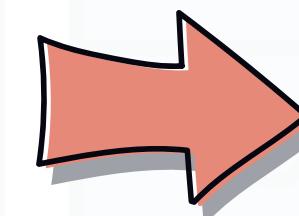
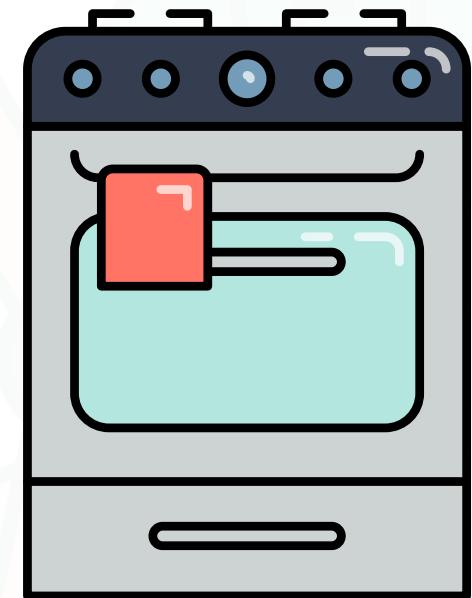


Input

Step 1



Step 2



Output

# Analogy ≡

What will be the output if we used chocolate instead of strawberries?

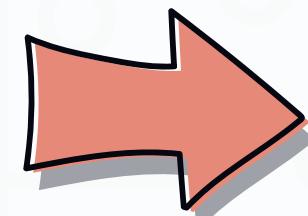
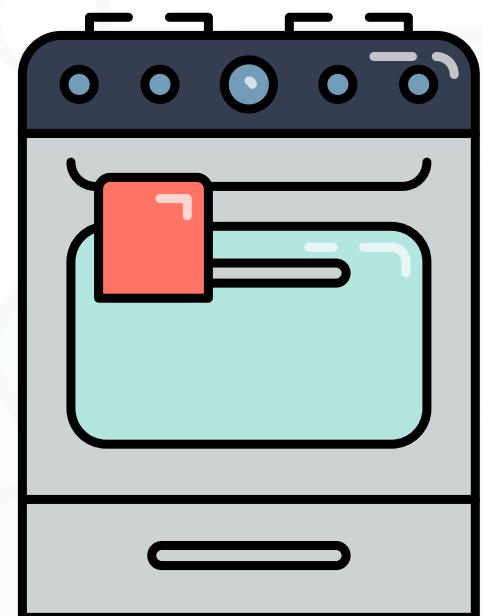


Input

Step 1



Step 2



Output

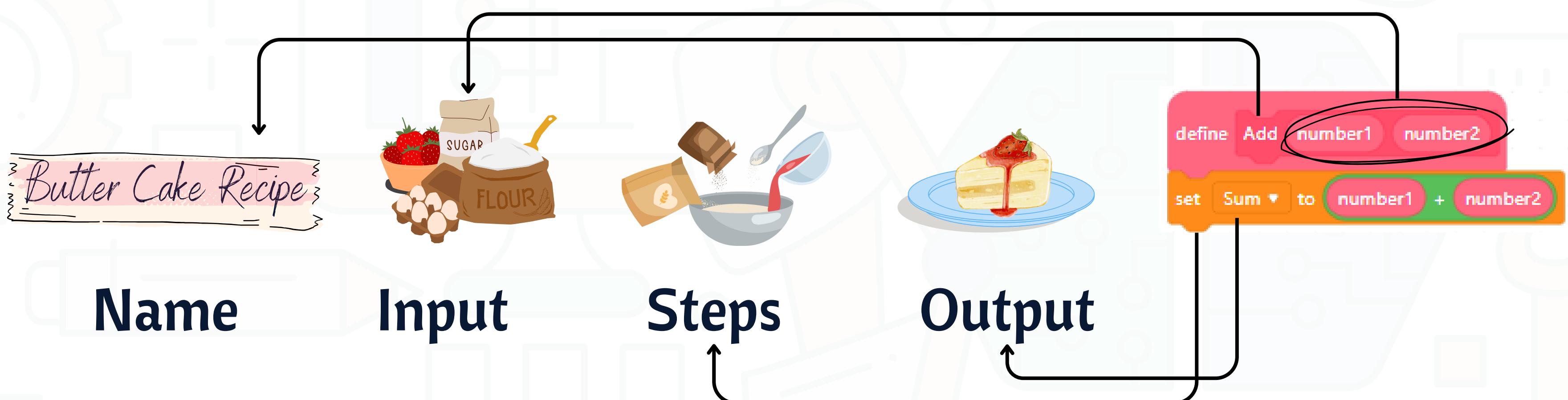
# Think

## How functions help us in coding?



# Analogy ≡

A function in programming is like a recipe for a computer. Just like how a recipe tells you how to make a cake, a function tells the computer what to do. Both have:

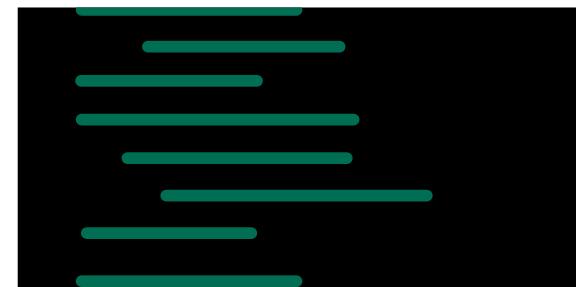


# Let's try it on mBlock

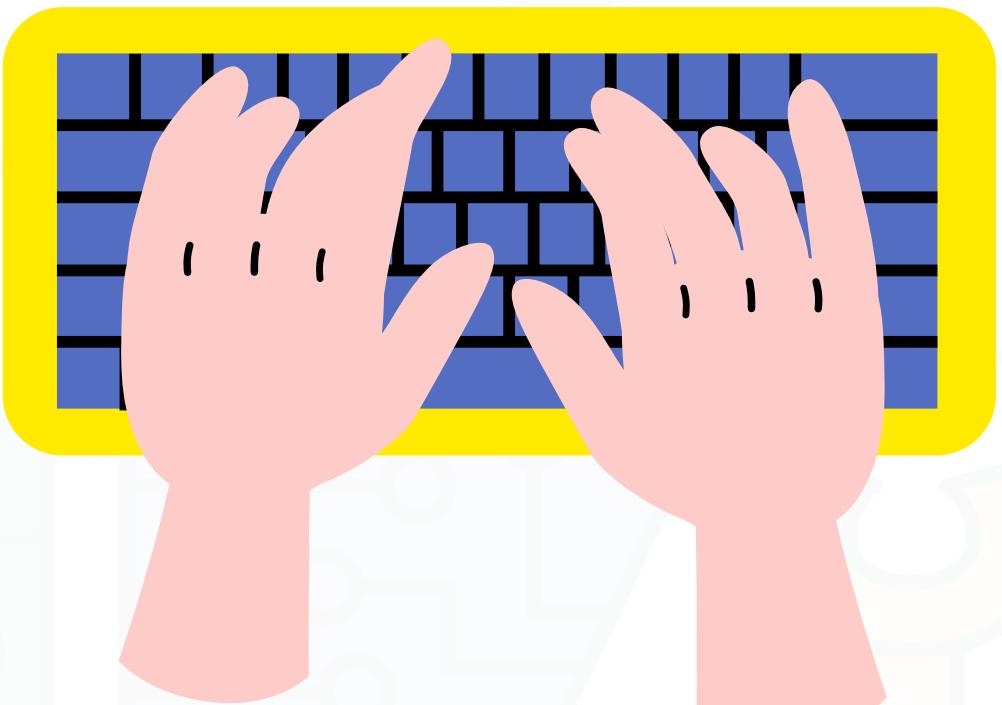


**Write a code to move forward and backward**

**Try it by yourself**



**Hint: Use begin function to Define pins.**

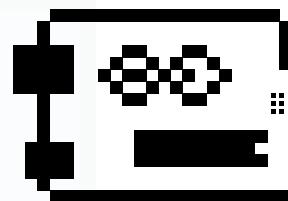


# Let's try it on mBlock



## Begin Function

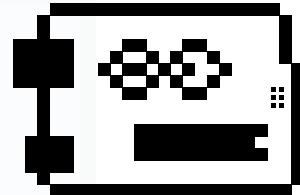
```
define begin
  set MotorBLS ▾ to 5
  set MotorFLS ▾ to 6
  set MotorBRS ▾ to 9
  set MotorFRS ▾ to 10
  set MotorBL1 ▾ to 7
  set MotorBL2 ▾ to 8
  set MotorFL1 ▾ to 11
  set MotorFL2 ▾ to 12
  set MotorBR1 ▾ to 13
  set MotorBR2 ▾ to 14
  set MotorFR1 ▾ to 15
  set MotorFR2 ▾ to 16
```



# Let's try it on mBlock

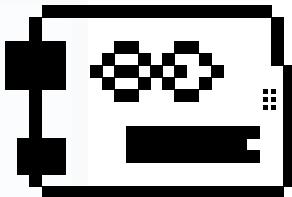
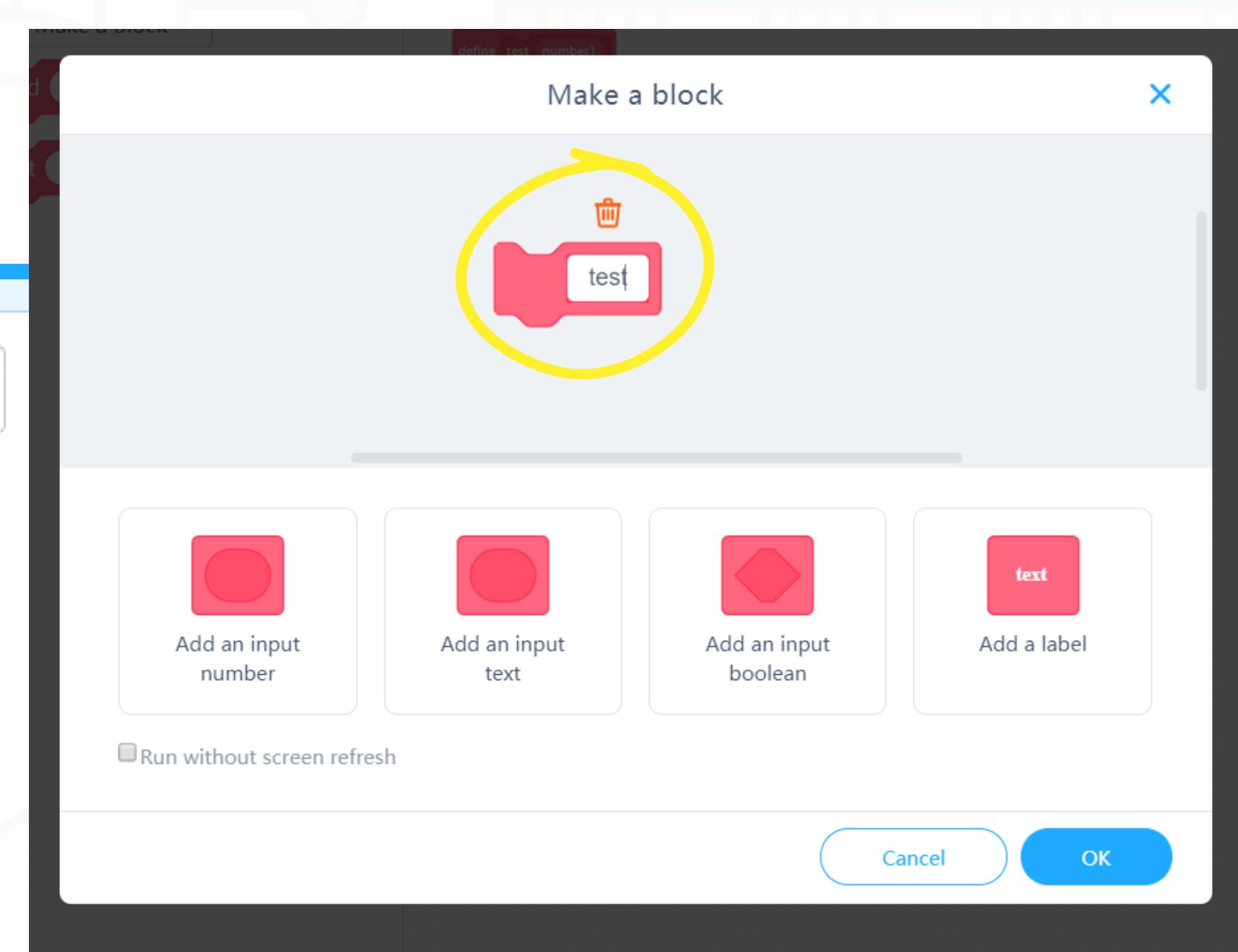
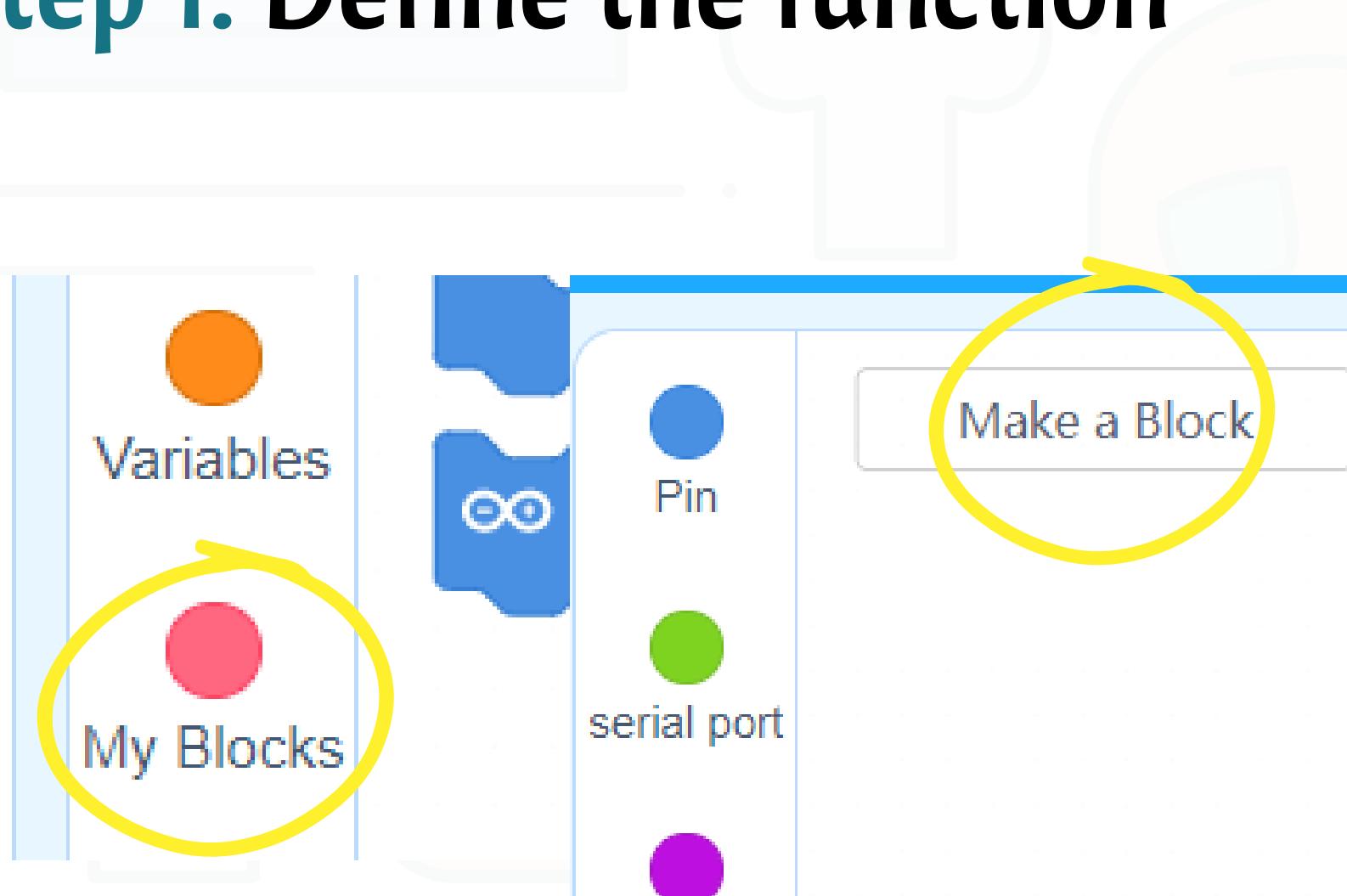


```
when Arduino starts up
begin
forever
    Forward 170
    wait 5 seconds
    Stop
    Backward 170
    wait 5 seconds
    Stop
end
```



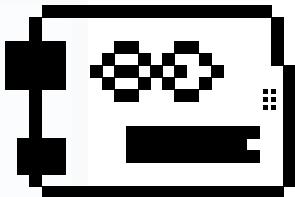
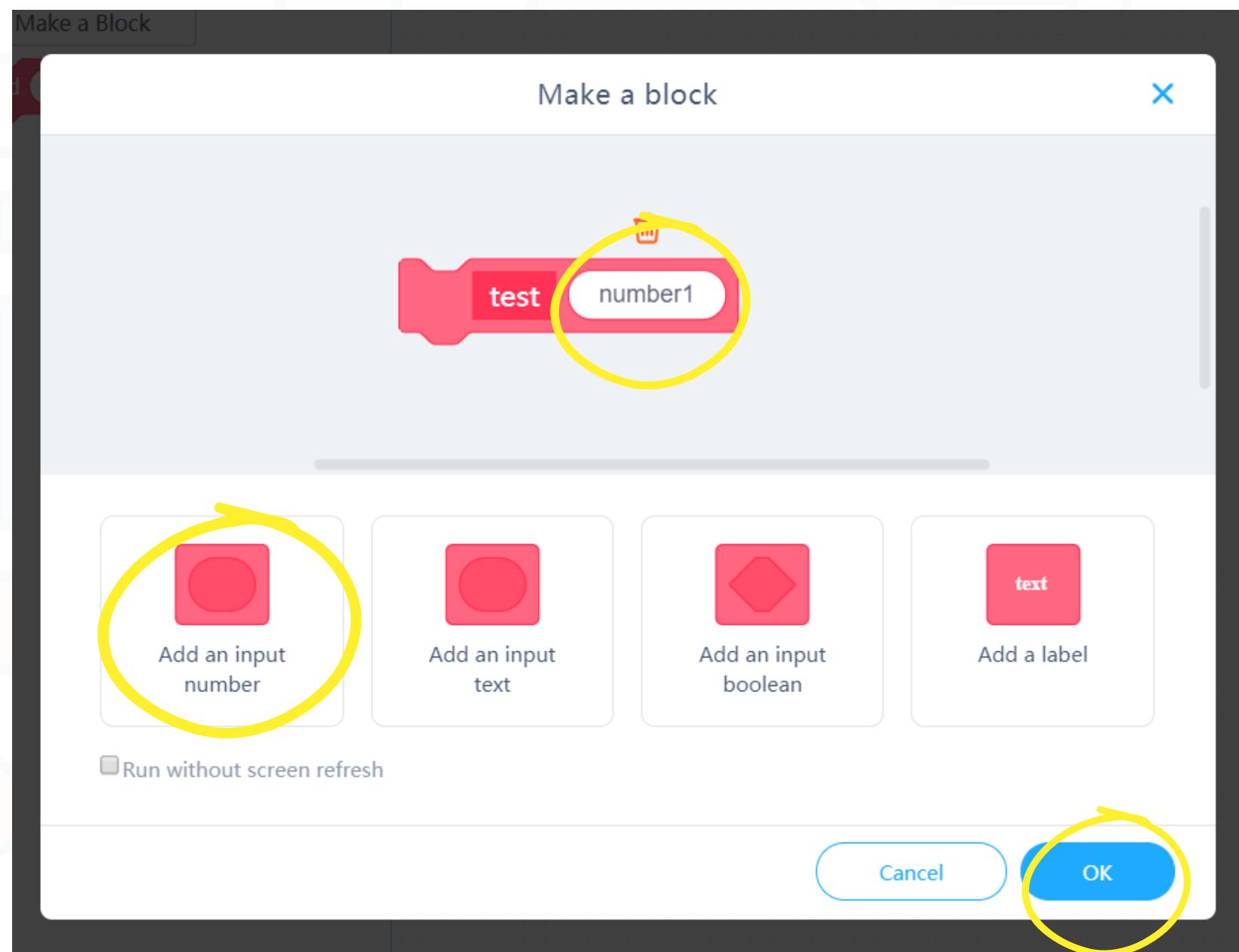
# Let's make functions

## Step 1: Define the function



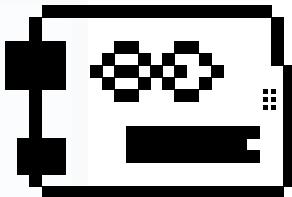
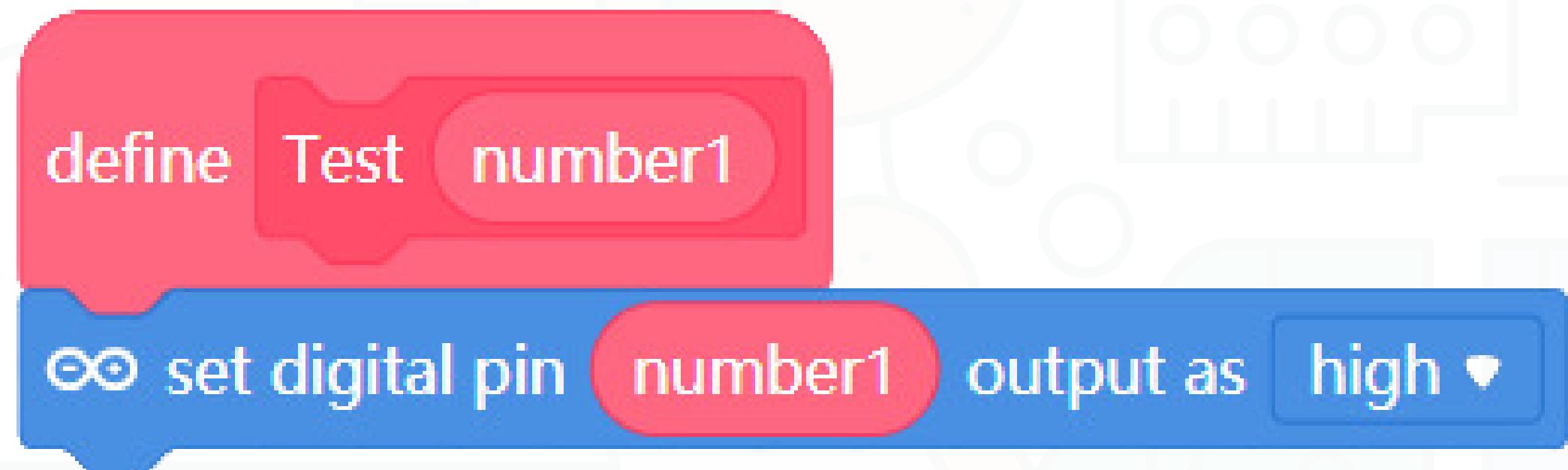
# Let's make functions

## Step 2: Define parameters



# Let's make functions

## Step 3: Build function block



# Let's try it on mBlock



**Write a code to rotate as a function**

**Try it by yourself**

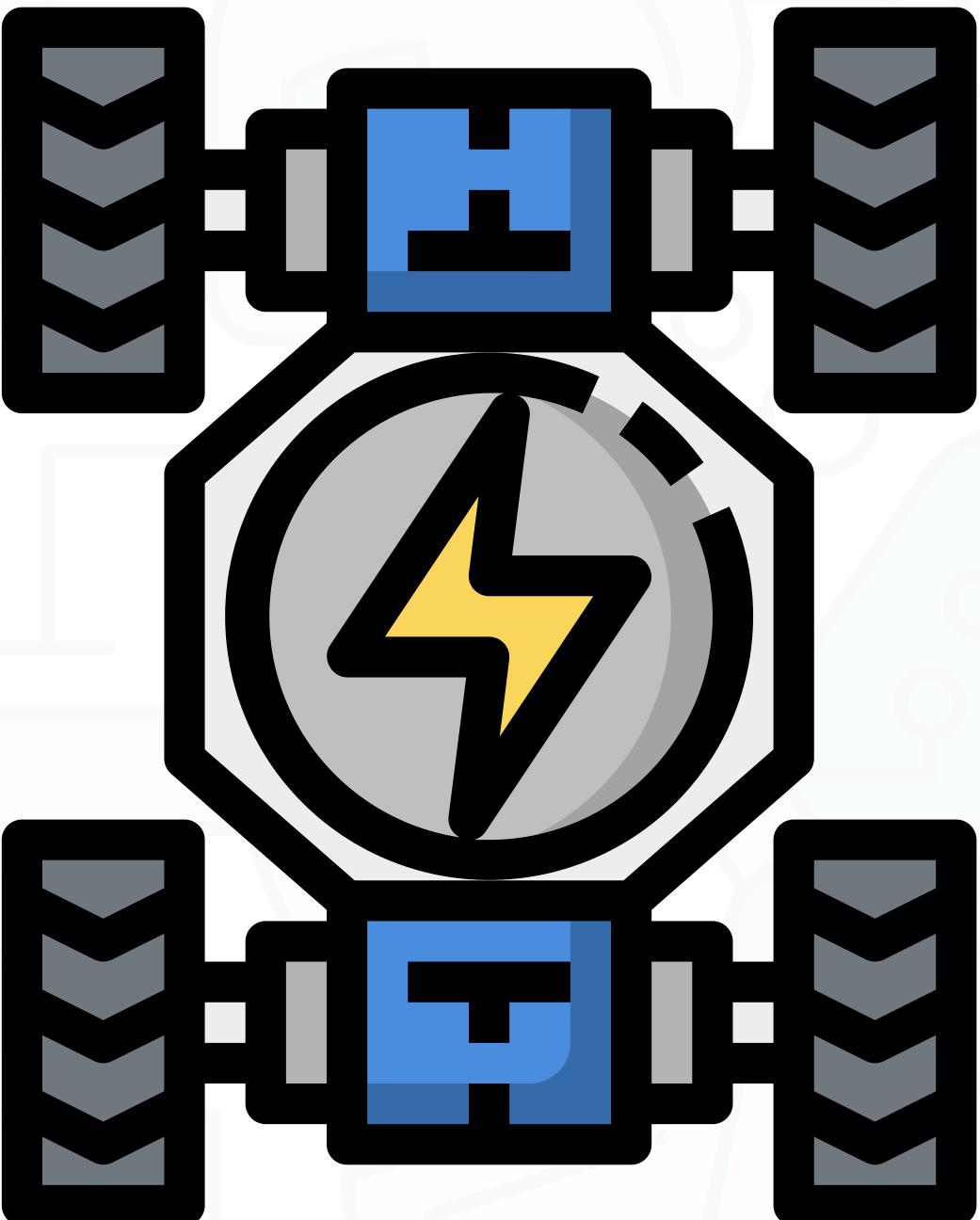
**Hint:** Use begin function to Define pins.



# Rotate The Robot

## Left Rotation

- Enable -> D6
- Input 1 -> D11
- Input2 -> D12



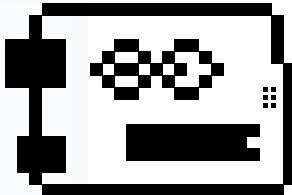
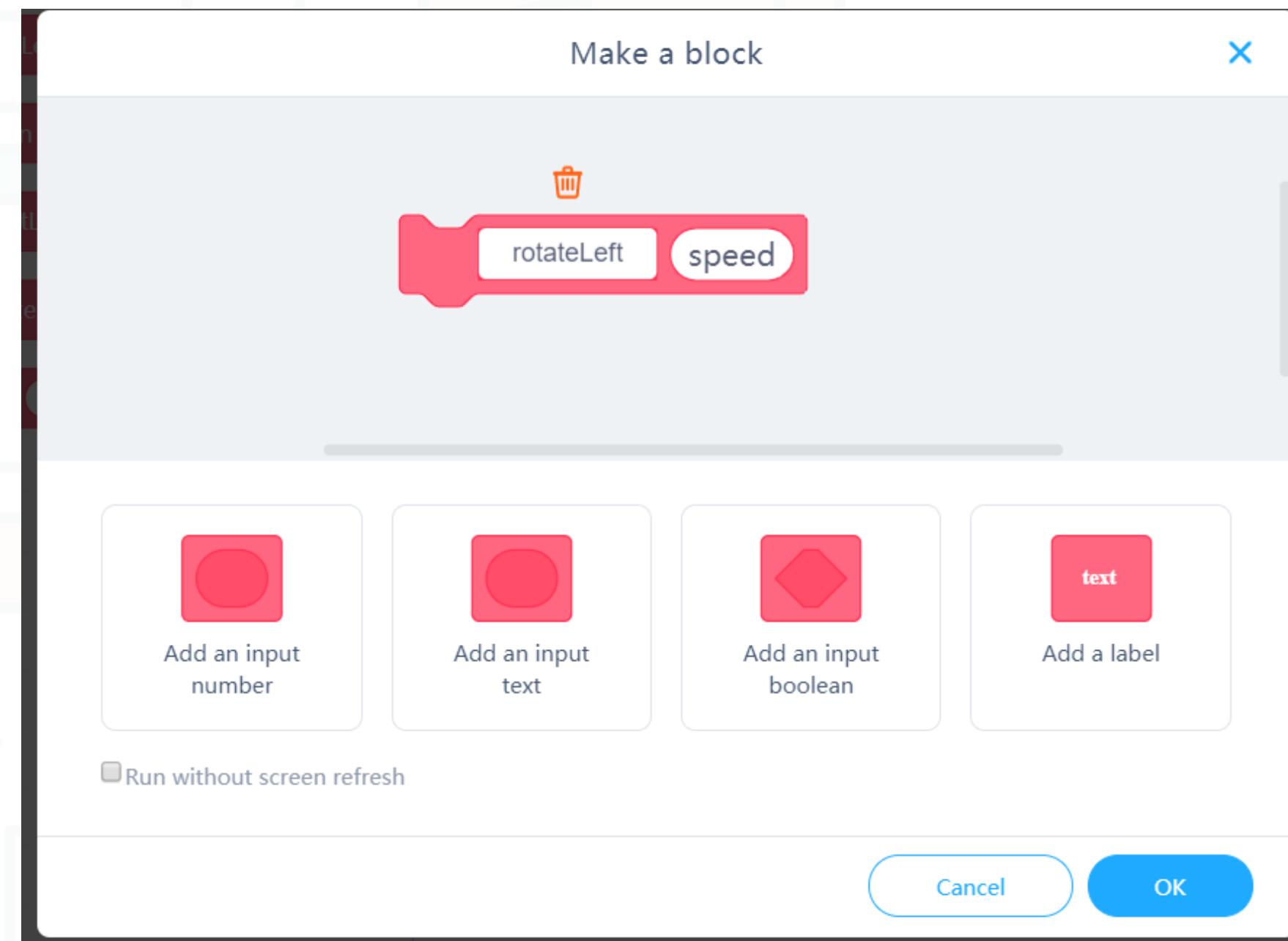
- Enable -> D10
- Input 1 -> A1(D15)
- Input2 -> A2(D16)

- Enable -> D5
- Input 1 -> D7
- Input2 -> D8

- Enable -> D9
- Input 1 -> D13
- Input2 -> A0(D14)

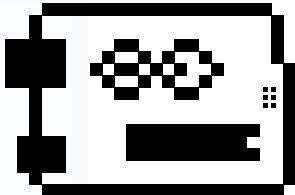
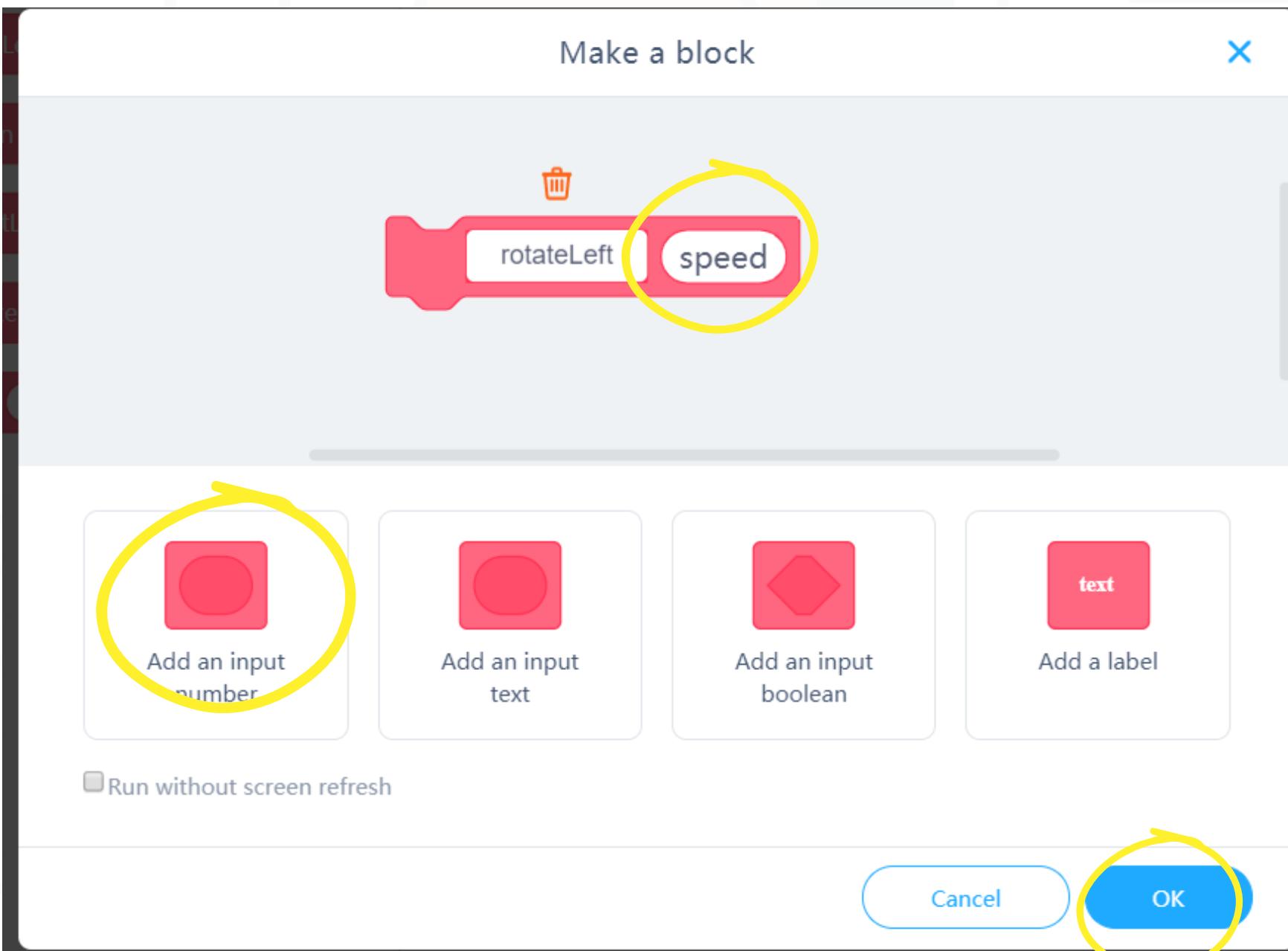
# Let's make functions

## Step 1: Define the function



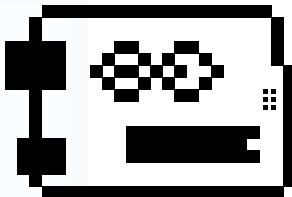
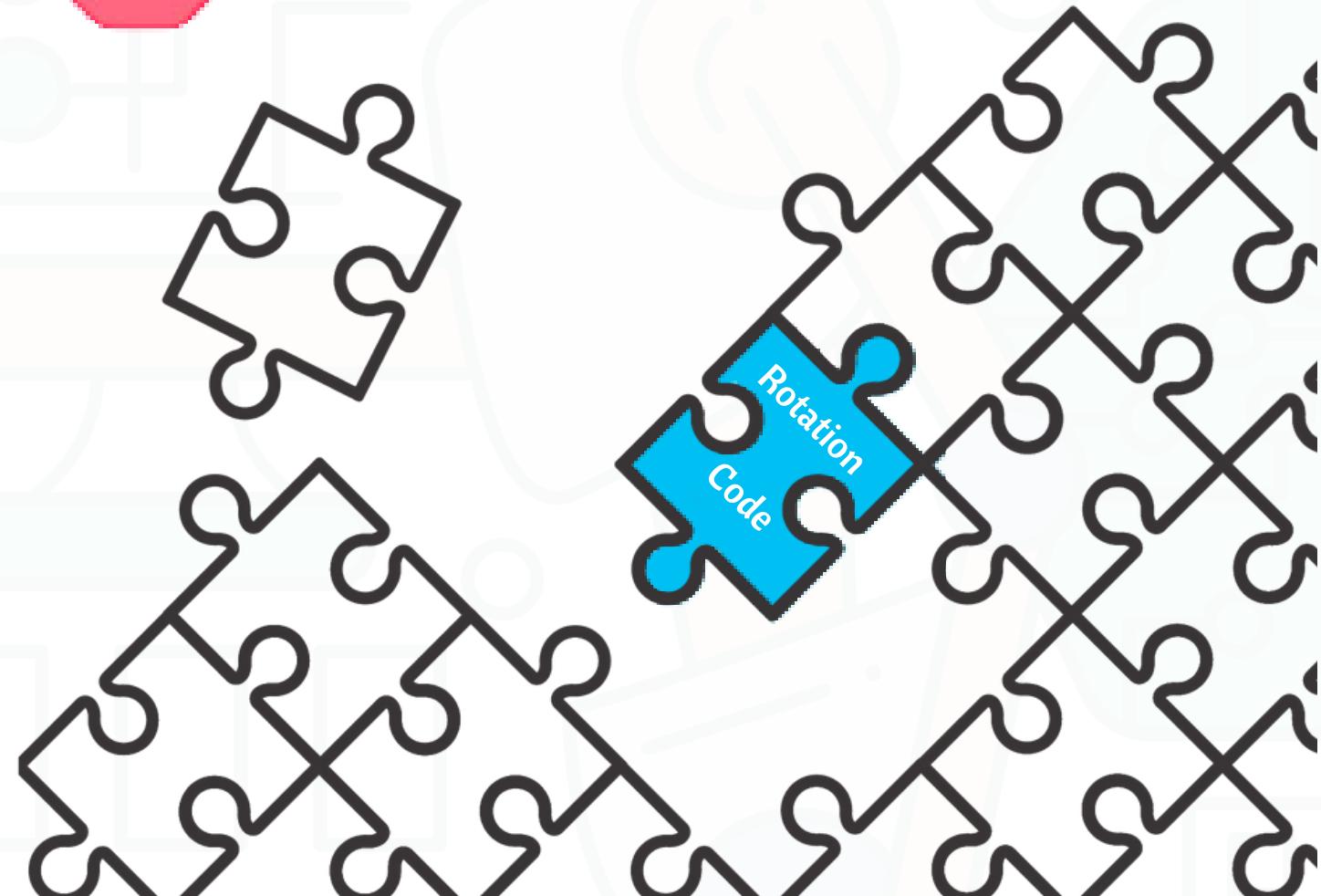
# Let's make functions

## Step 2: Define parameters



# Let's make functions

## Step 3: Build function block



# Let's make functions

## Step 4: Build function block

```
define rotateLeft speed
  @@ set PWM 5 output as speed
  @@ set PWM 6 output as speed
  @@ set PWM 9 output as speed
  @@ set PWM 10 output as speed
```

Set motors' speed

```
define rotateLeft speed
  @@ set PWM 5 output as speed
  @@ set PWM 6 output as speed
  @@ set PWM 9 output as speed
  @@ set PWM 10 output as speed
  @@ set digital pin 13 output as high ▾
  @@ set digital pin 14 output as low ▾
  @@ set digital pin 15 output as high ▾
  @@ set digital pin 16 output as low ▾
```

Move the right  
wheels forward

```
define rotateLeft speed
  @@ set PWM 5 output as speed
  @@ set PWM 6 output as speed
  @@ set PWM 9 output as speed
  @@ set PWM 10 output as speed
  @@ set digital pin 13 output as high ▾
  @@ set digital pin 14 output as low ▾
  @@ set digital pin 15 output as high ▾
  @@ set digital pin 16 output as low ▾
  @@ set digital pin 7 output as low ▾
  @@ set digital pin 8 output as high ▾
  @@ set digital pin 11 output as low ▾
  @@ set digital pin 12 output as high ▾
```

Move the left  
wheels backward

