



Armstrong

School Program 2023-2024

Lesson 6



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Lesson Content



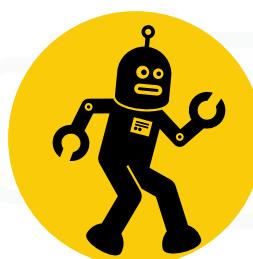
Revising motor movement



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 ▾
```

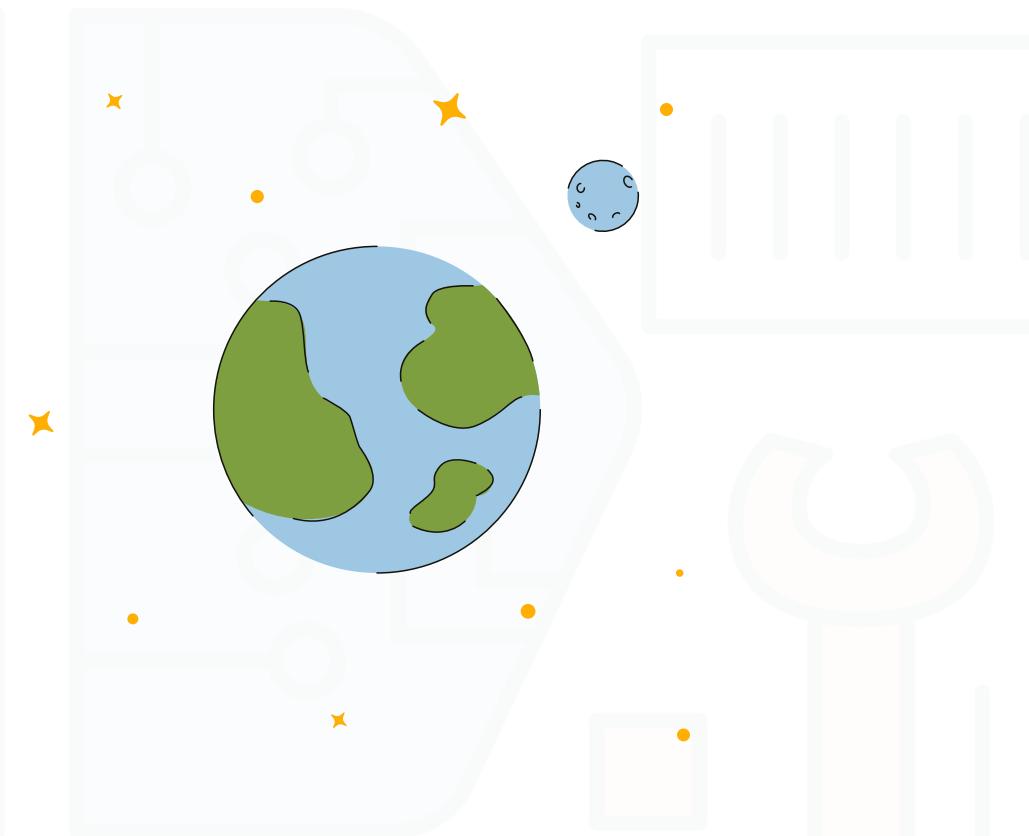
Rotation

What is rotation?

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

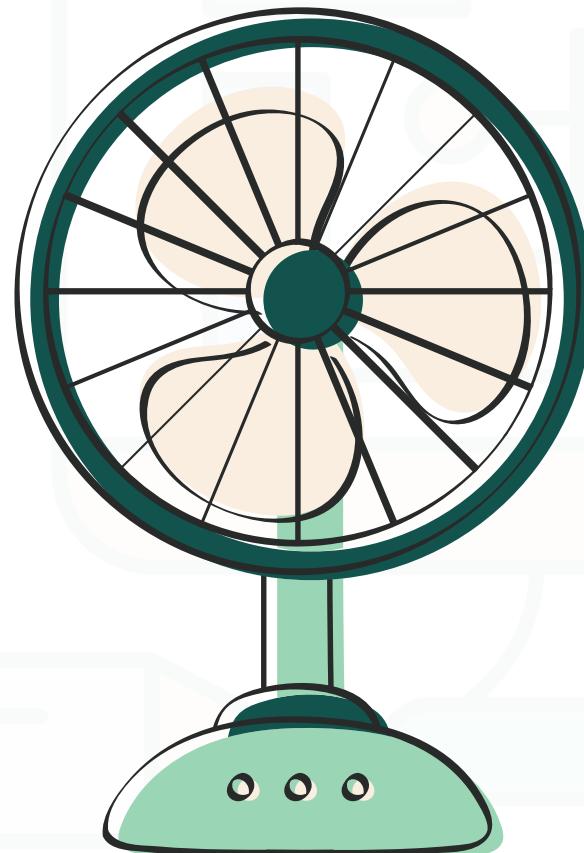
How do we rotate?

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

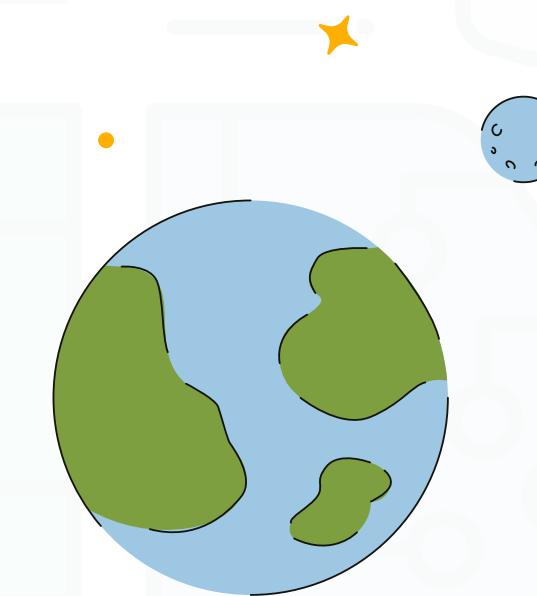


Axis of Rotation

Object's Center

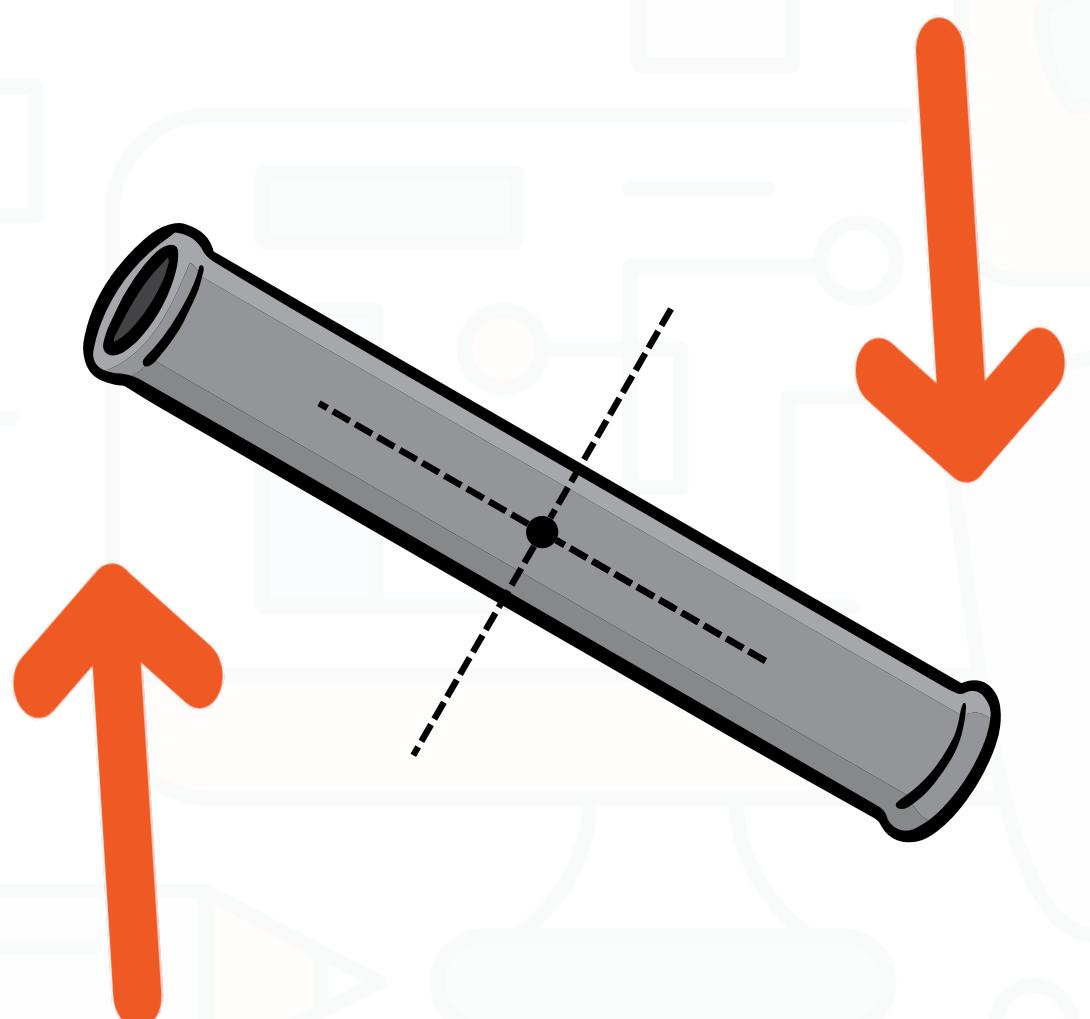


Point Outside The
Objects Body

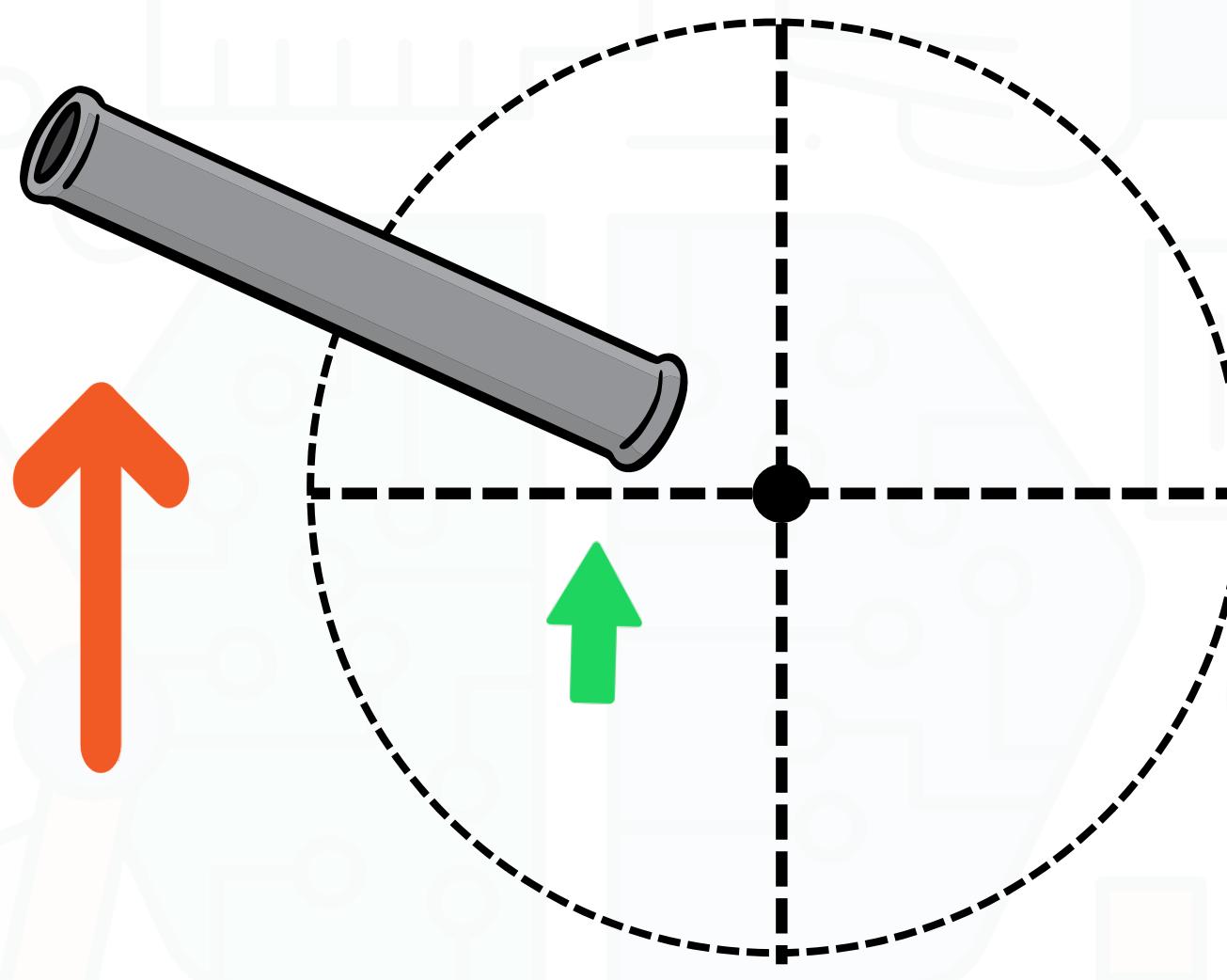


Axis of Rotation

Object's Center



Point Outside The
Objects Body



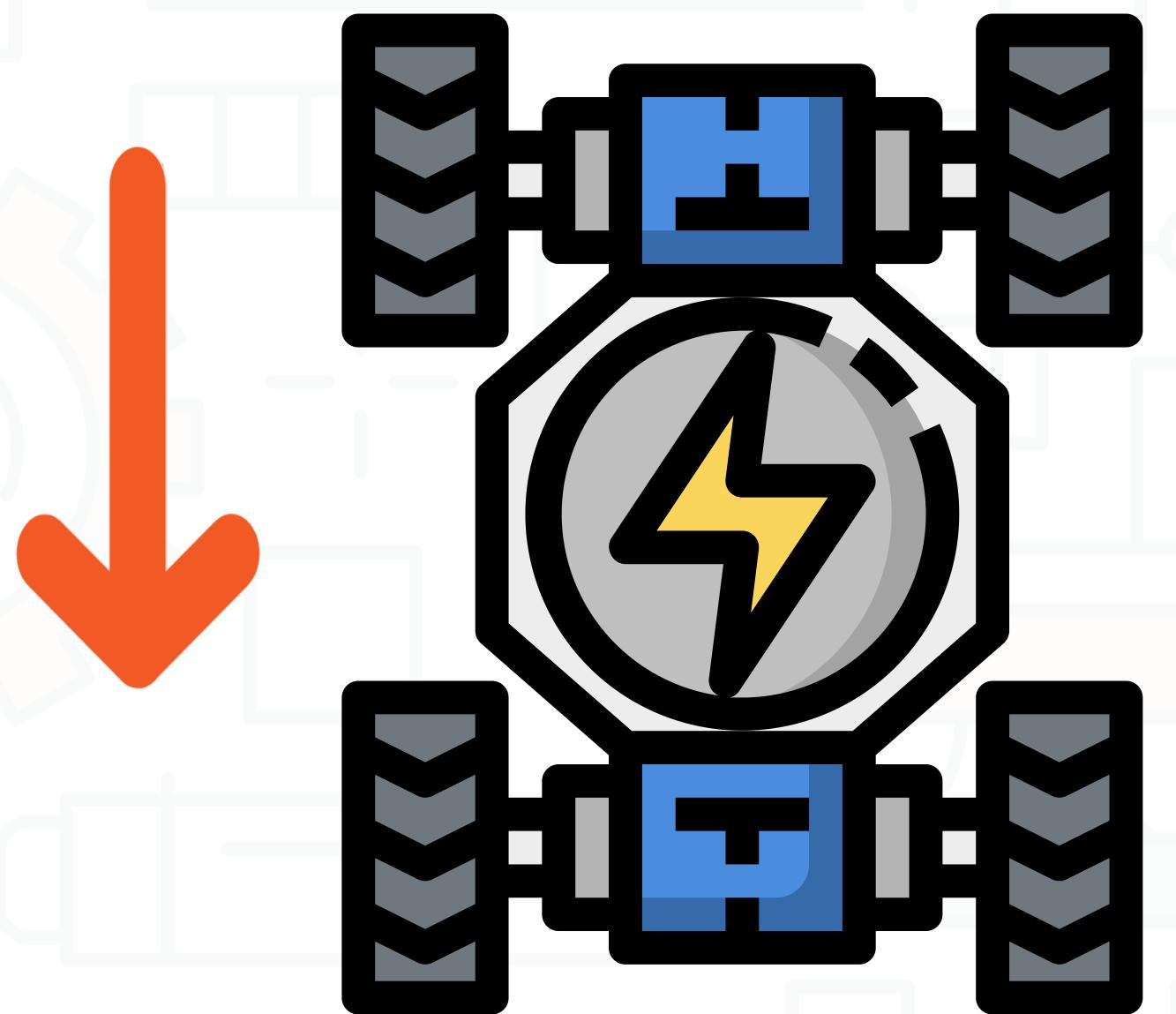
Think

How can we make the robot rotate about its center?

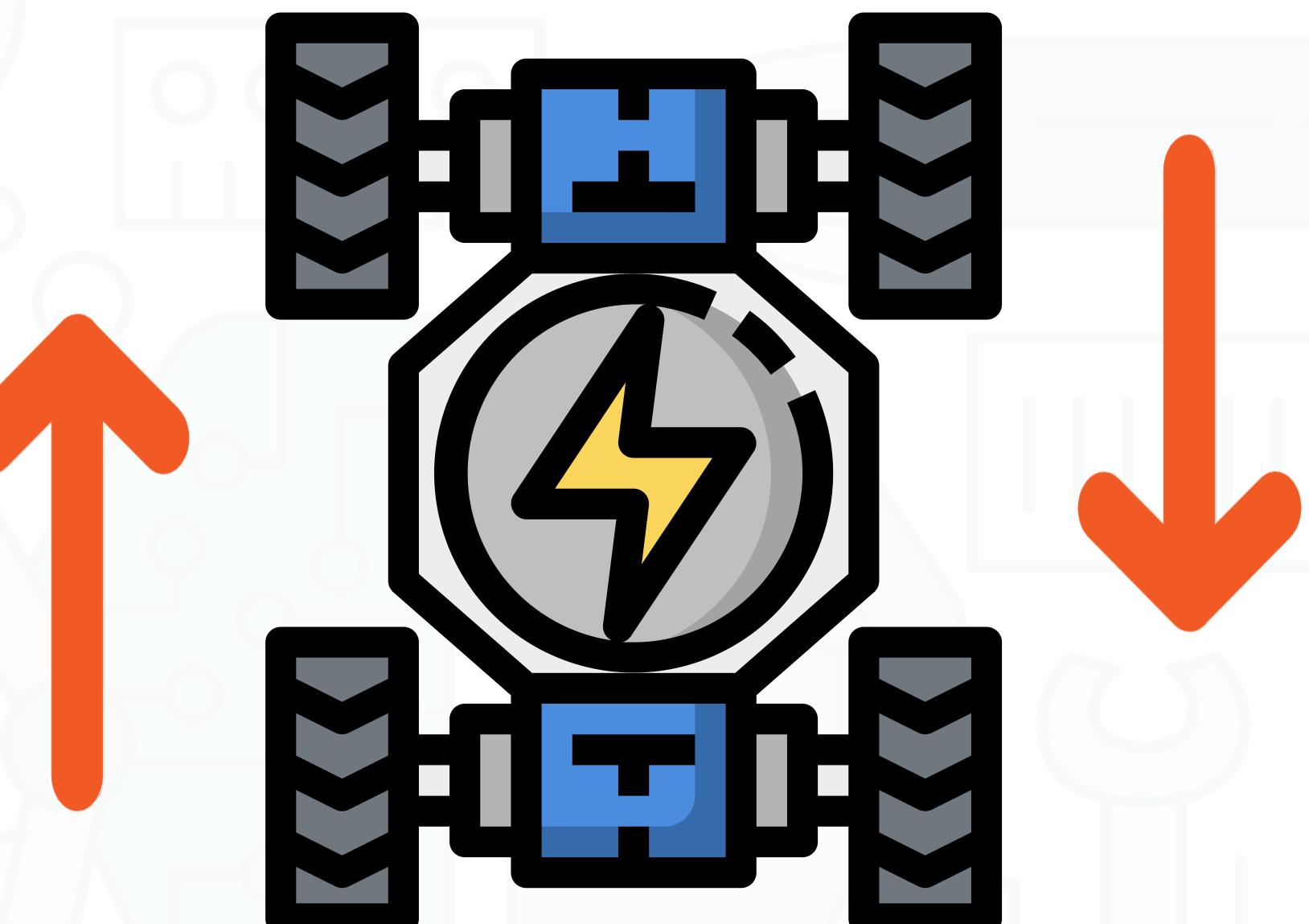


Rotate The Robot

Left Rotation



Right Rotation



Let's try it on mBlock

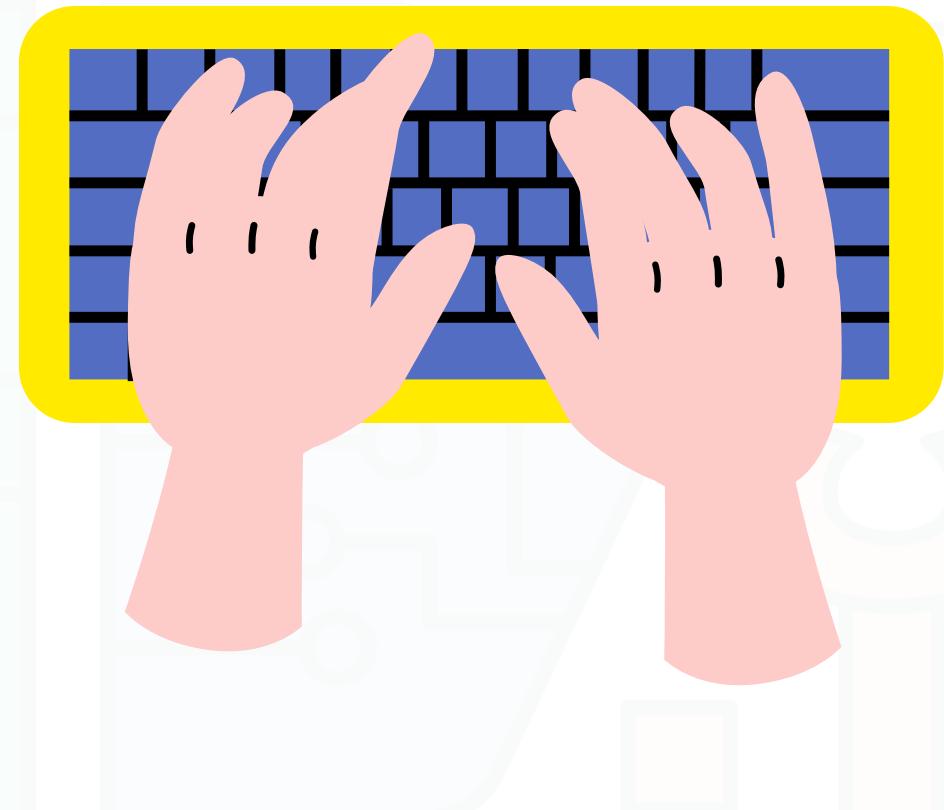


Write a code to rotate the robot about its center.

Try it by yourself



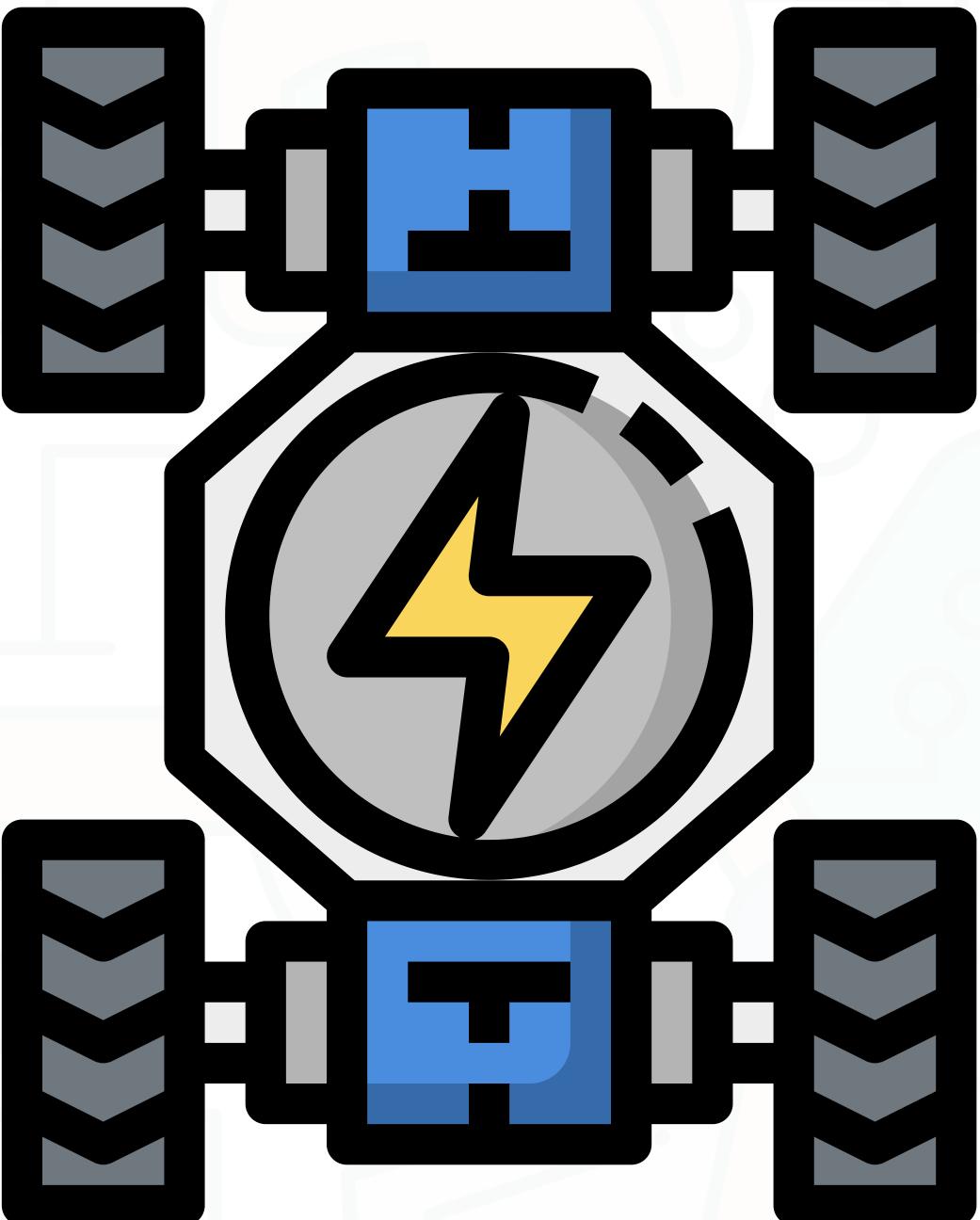
Hint: Remember forward and backward codes.



Rotate The Robot

Left Rotation

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



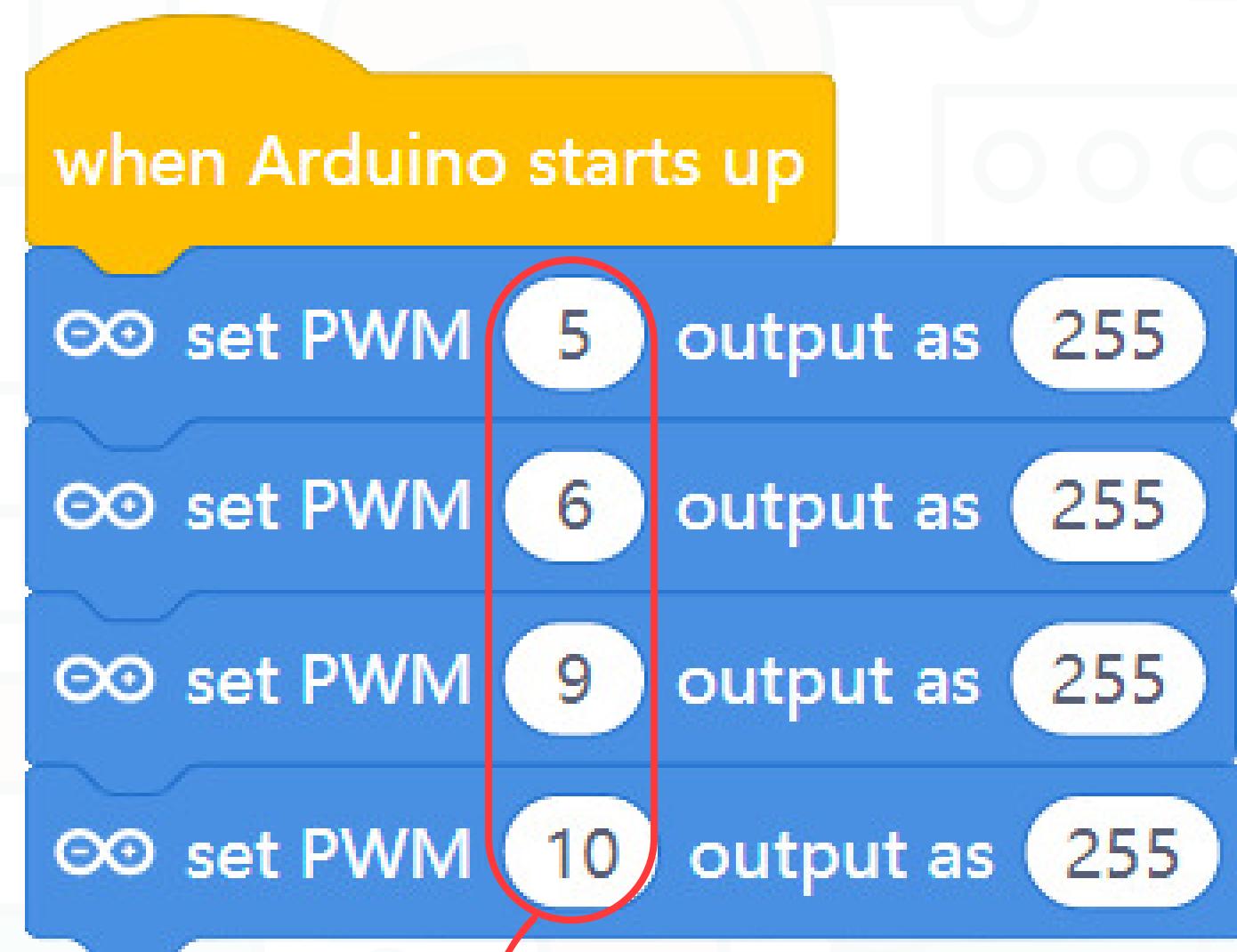
- Enable -> D5
- Input 1 -> D7
- Input2 -> D8

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

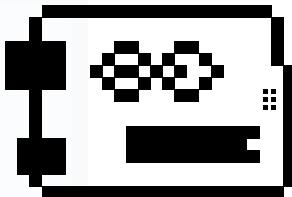
- Enable -> D9
- Input 1 -> D13
- Input2 -> A0(D14)

Let's rotate the robot

Step 1: Set motors' speed

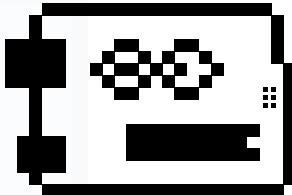
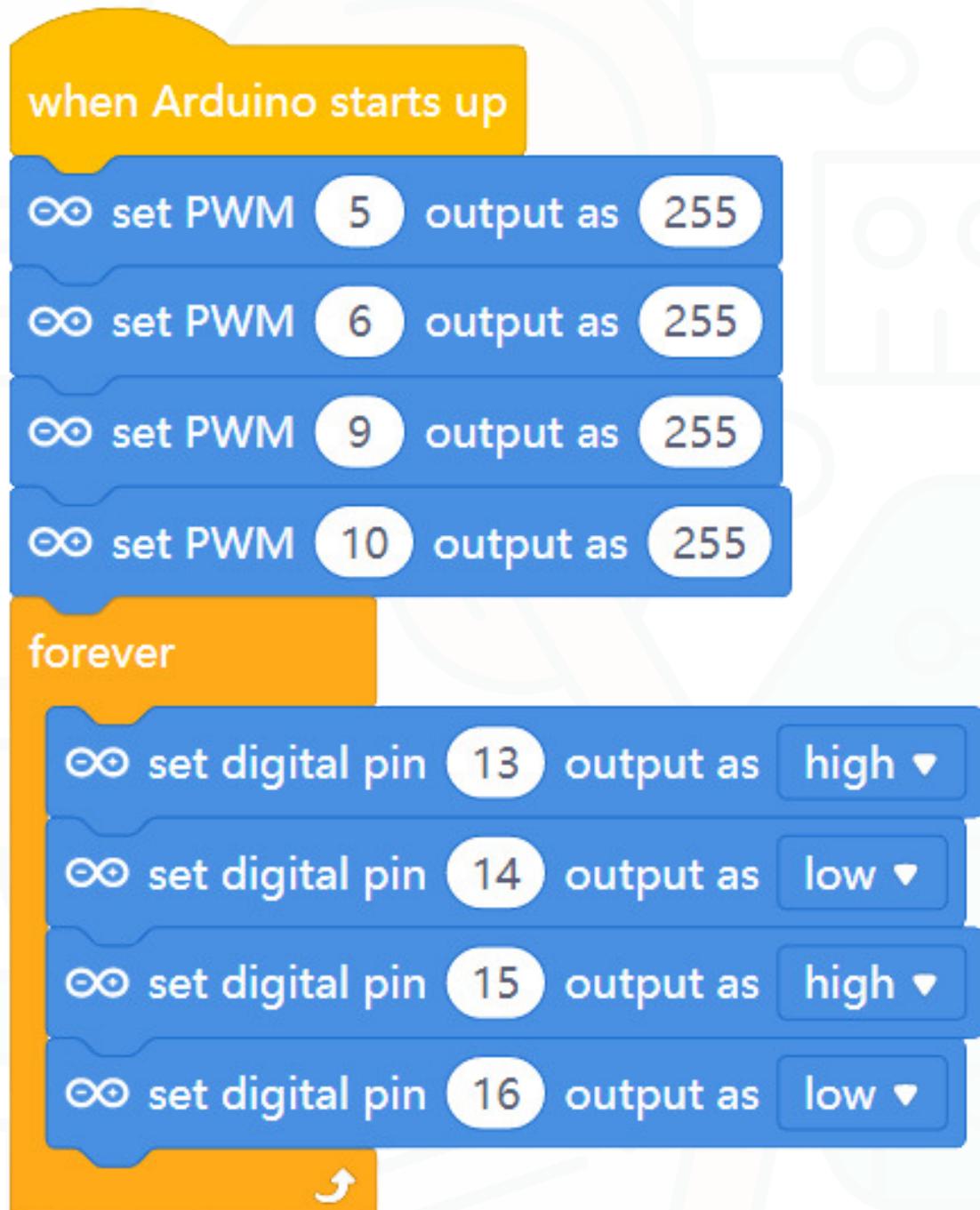


PWM pins



Let's rotate the robot

Step 2: Move the right wheels forward



Let's rotate the robot

Step 3: Move the left wheels backward



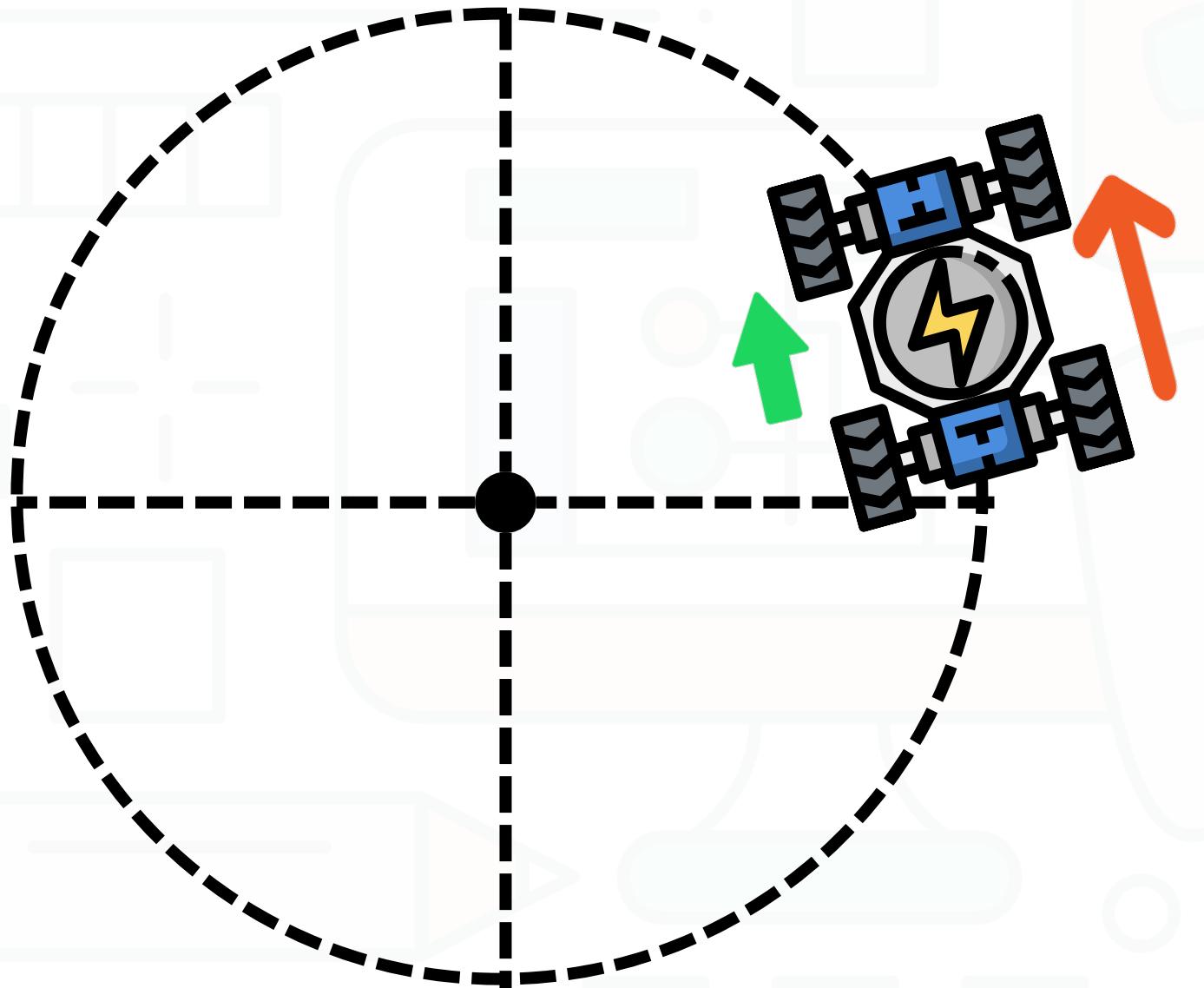
Think

How can we make the robot rotate around an object?

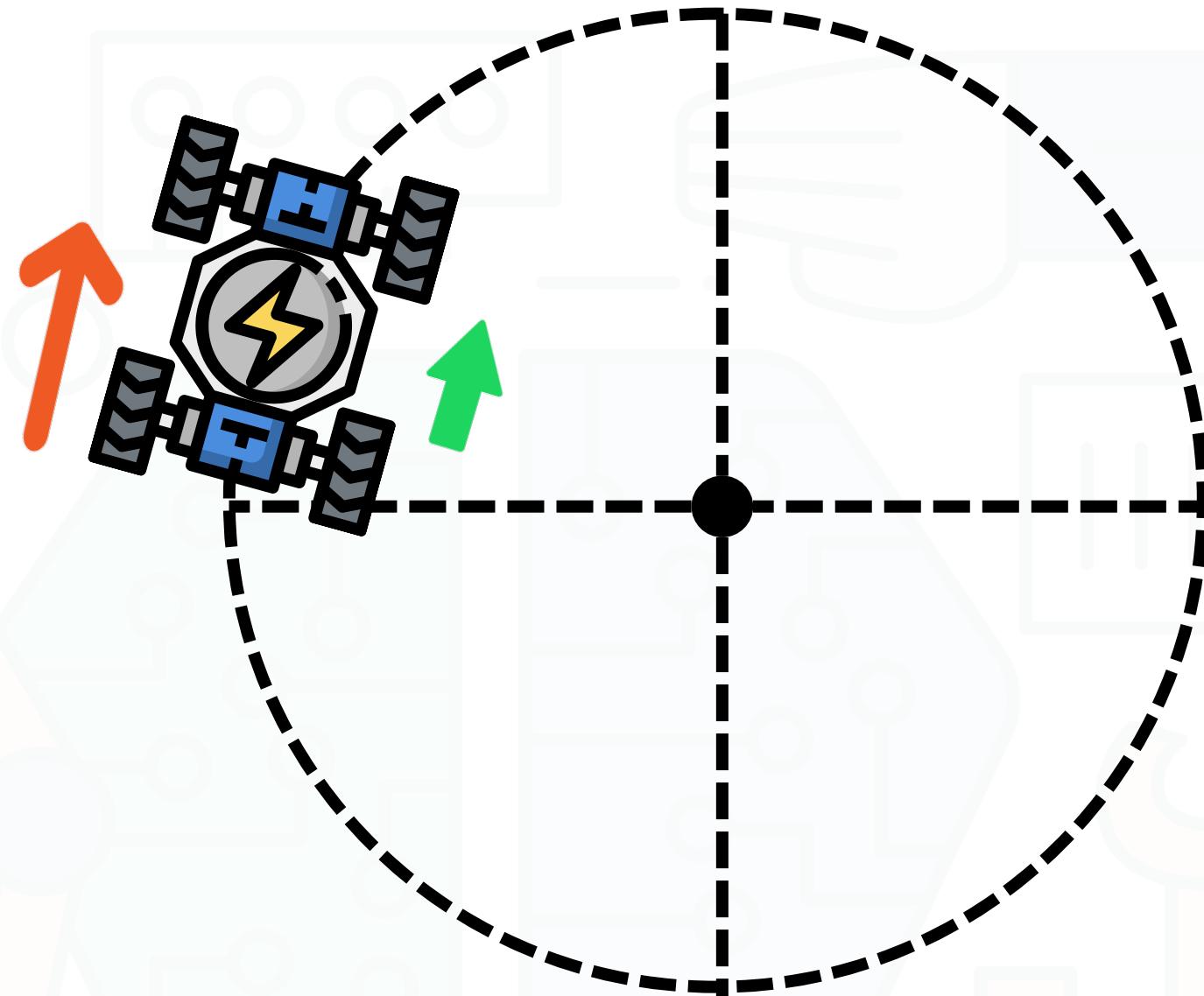


Rotate The Robot

Left Curve Forward

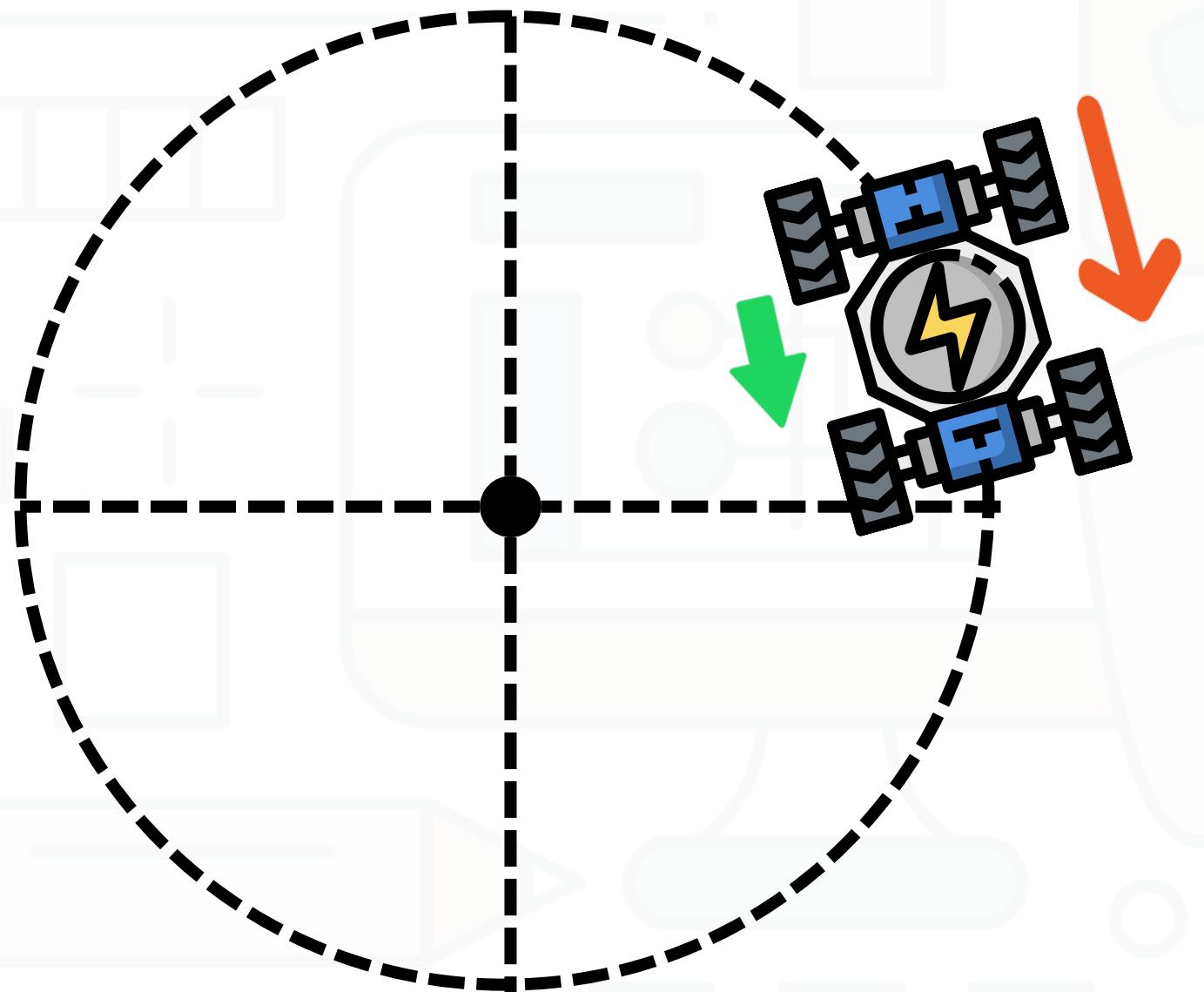


Right Curve Forward

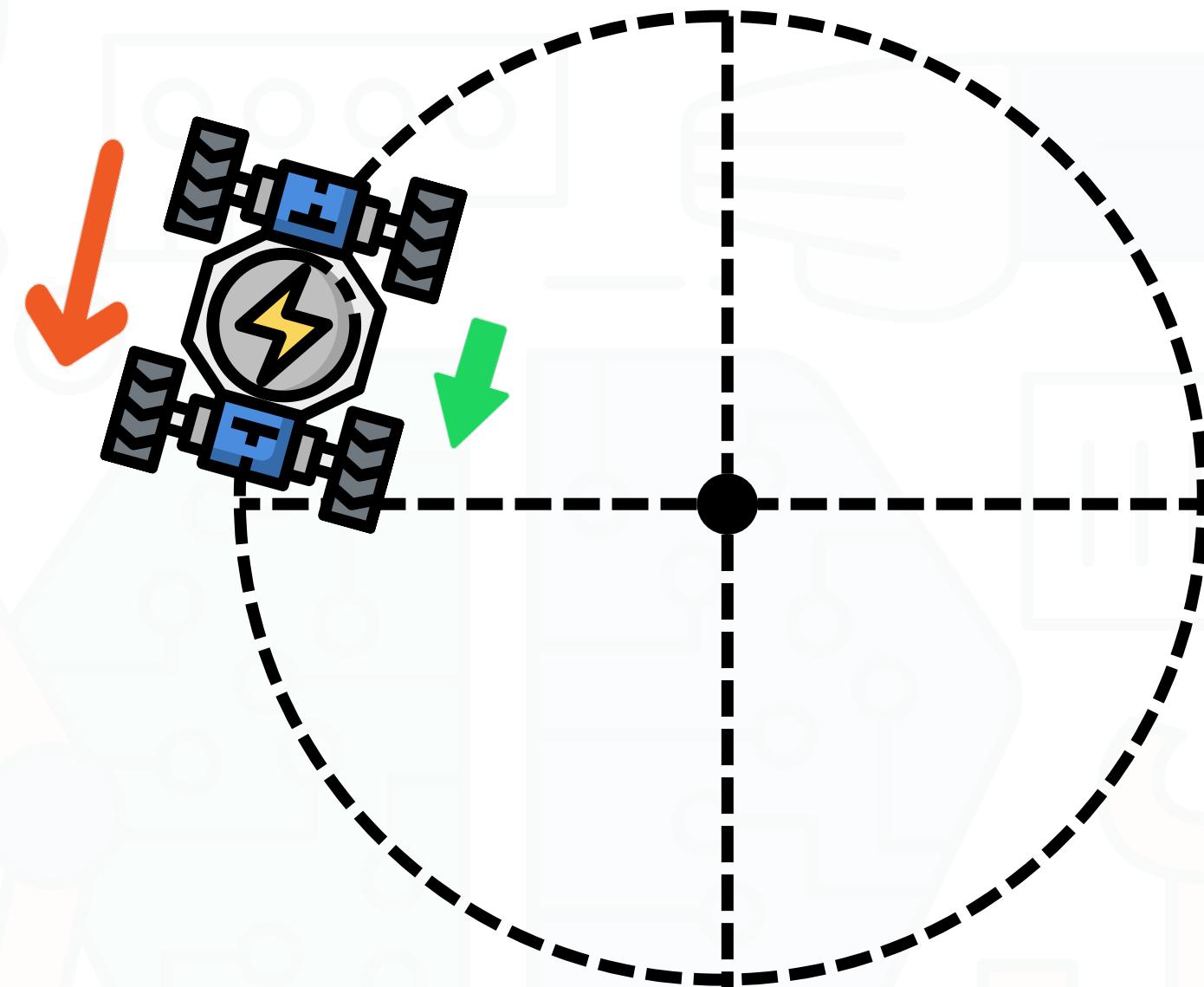


Rotate The Robot

Left Curve Backward



Right Curve Backward



Let's try it on mBlock

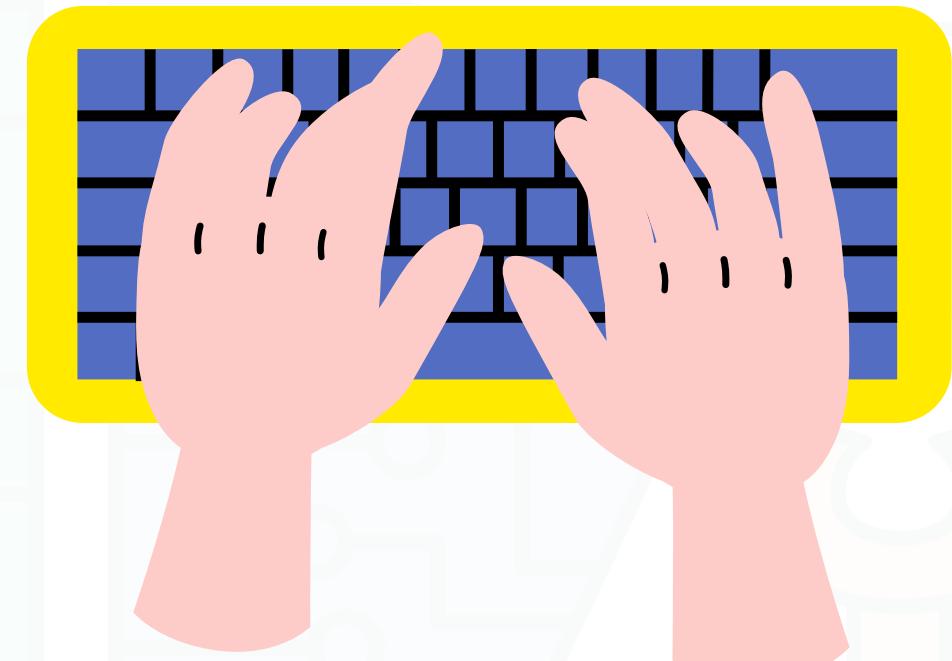


Write a code to rotate the robot about its center.

Try it by yourself

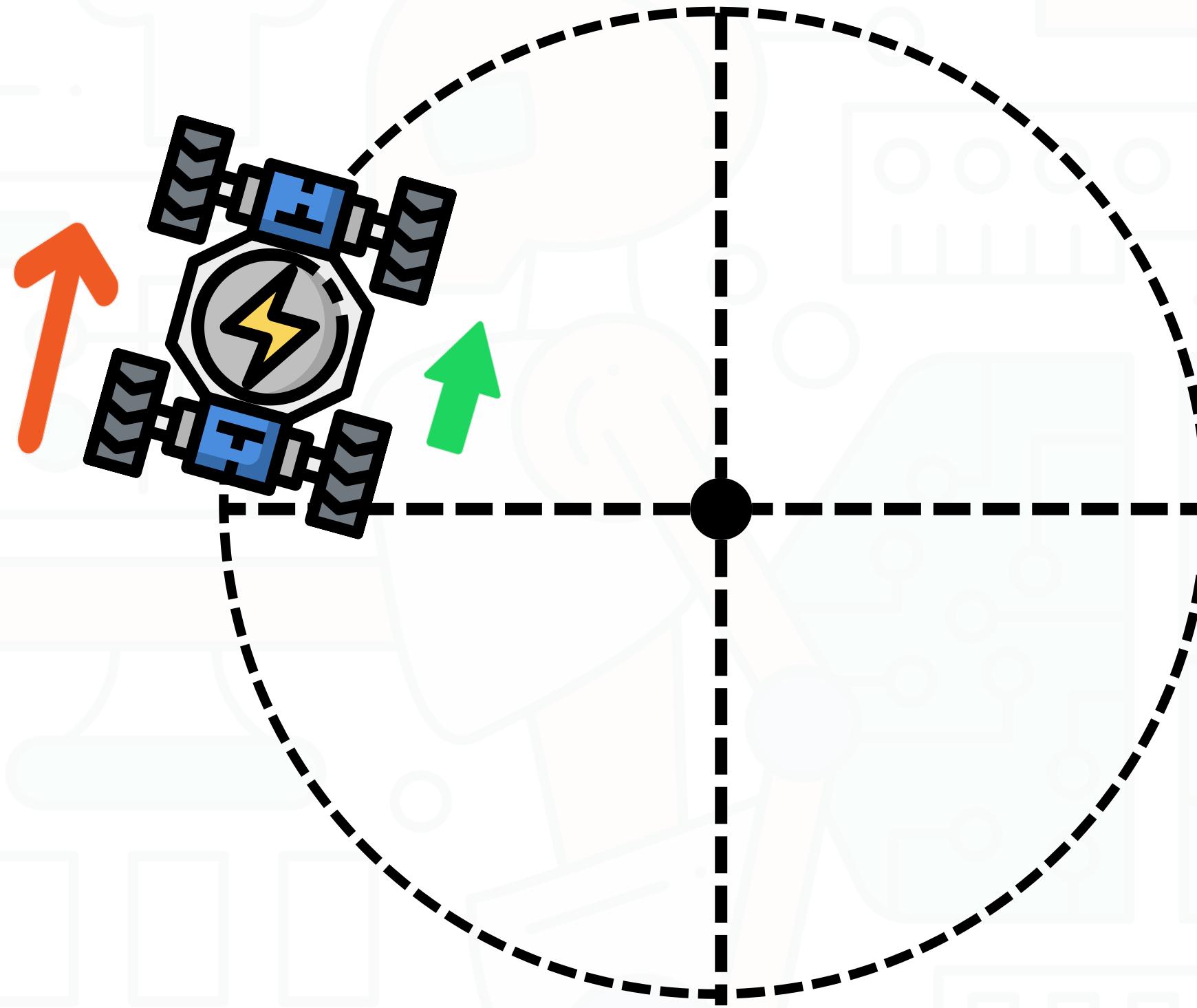


Hint: Use PWM to set speed.



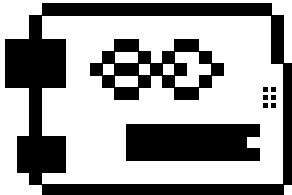
Rotate The Robot

Right Rotation



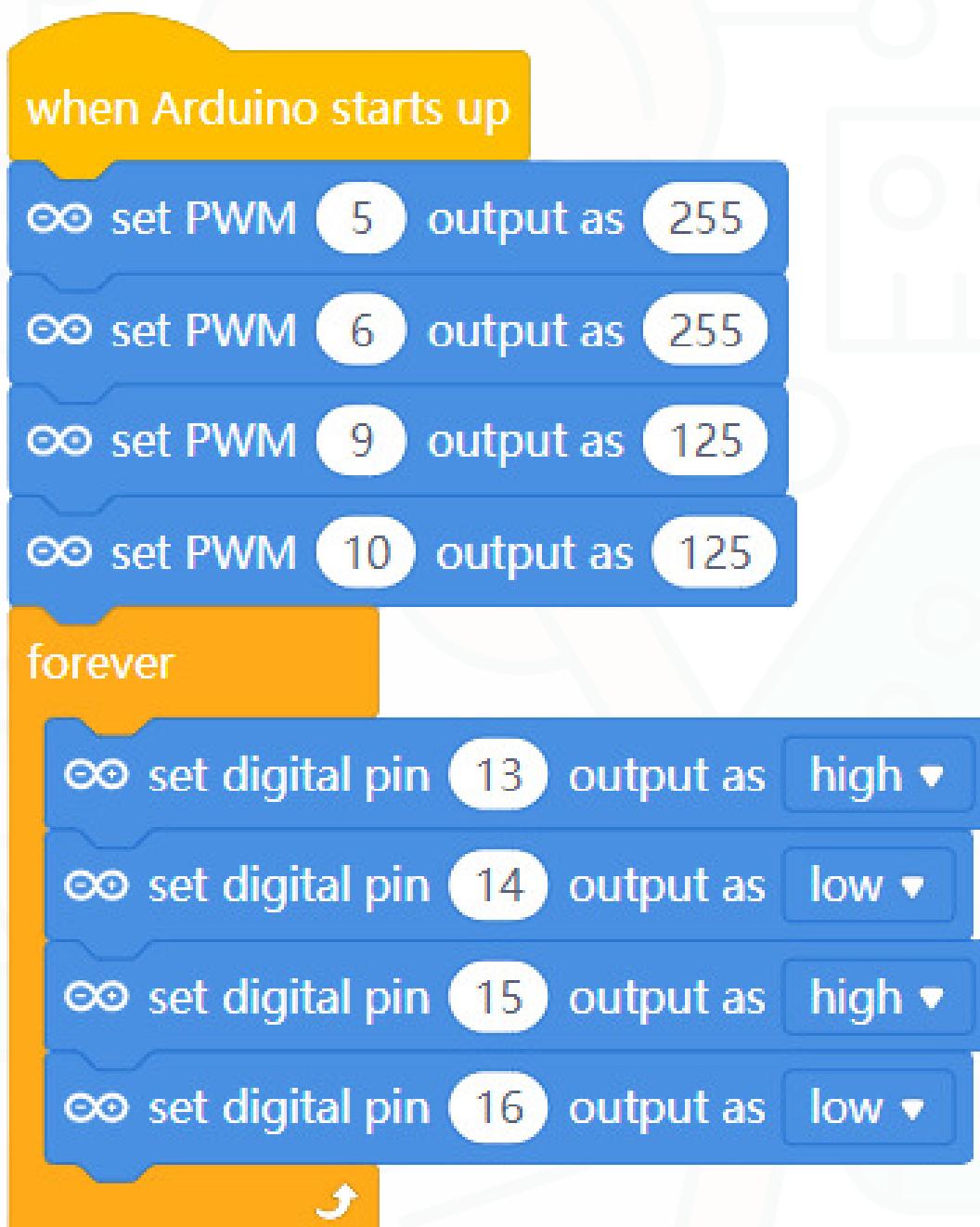
Let's rotate the robot

Step 1: Set motors' speed



Let's rotate the robot

Step 2: Moving the right wheels forward



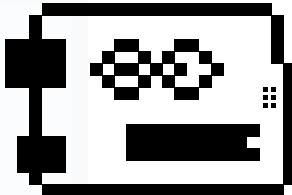
A Scratch script consisting of two main sections: "when Arduino starts up" and "forever".

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

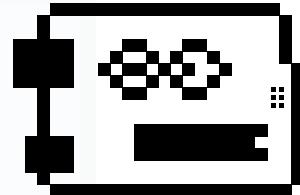
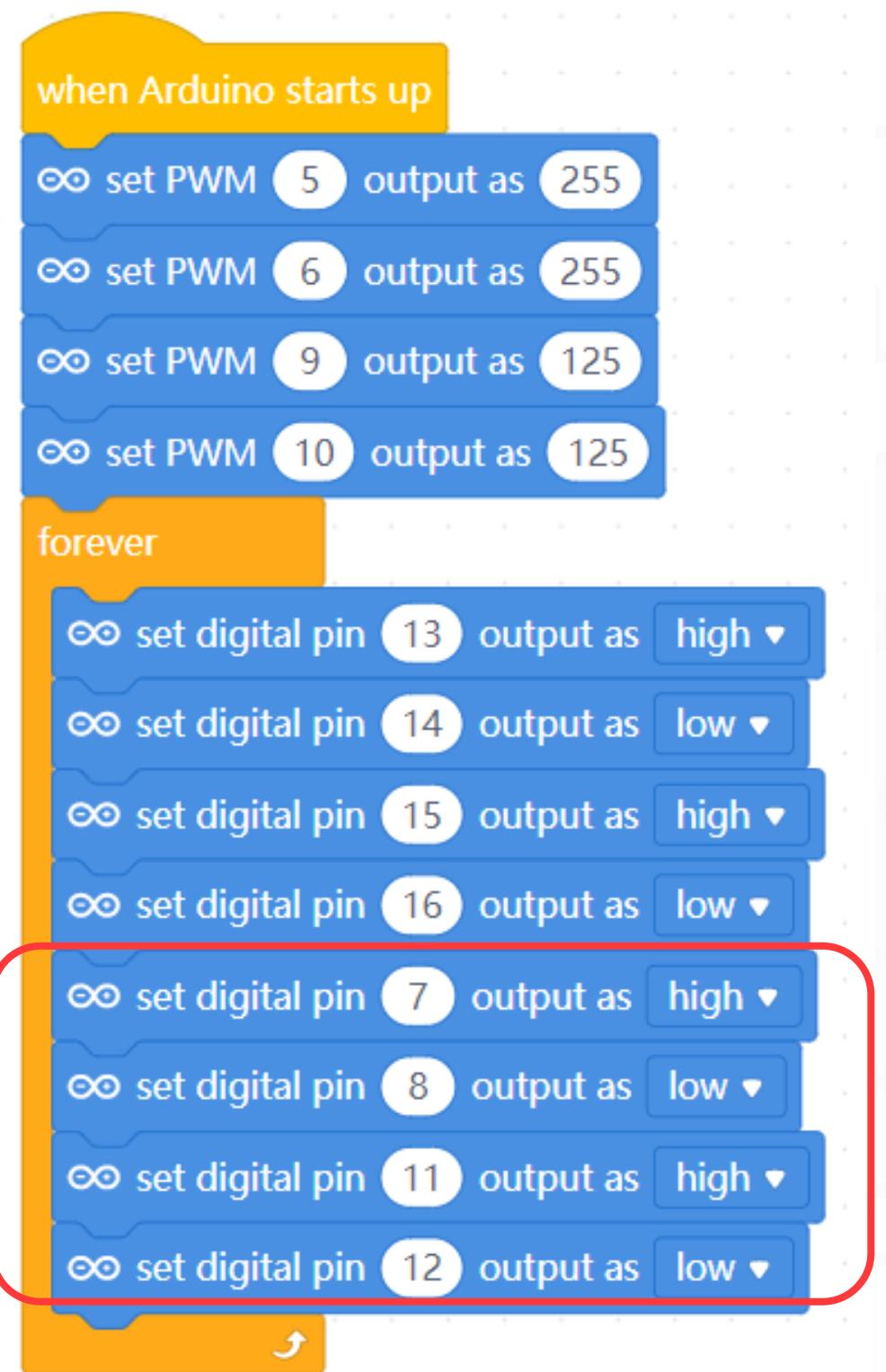
forever:

- 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?



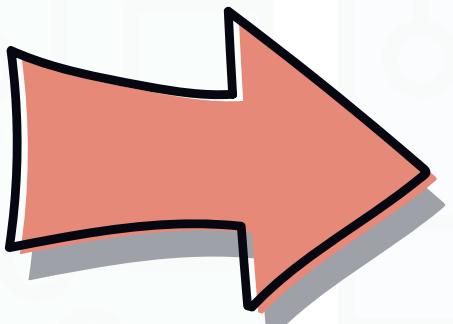
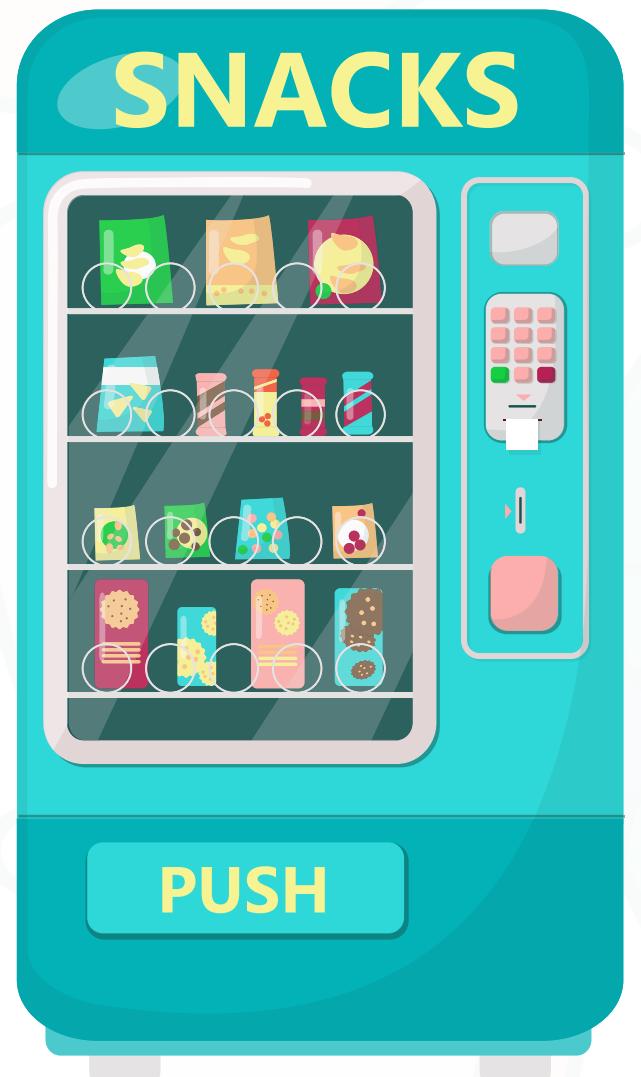
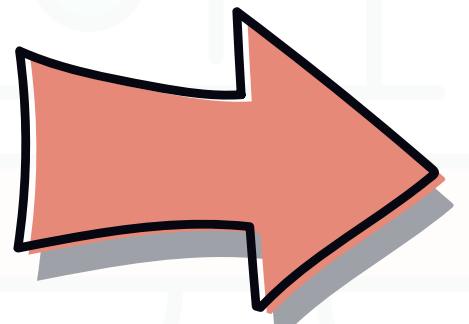
Functions

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?

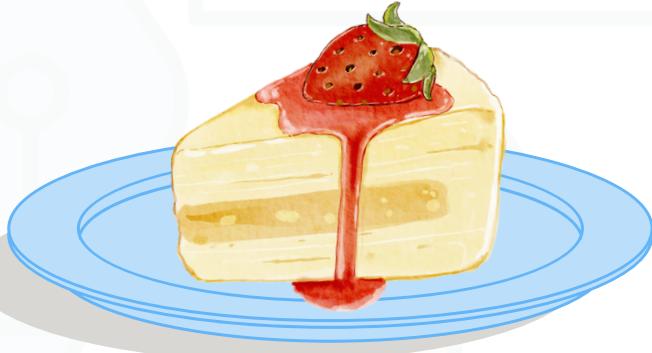
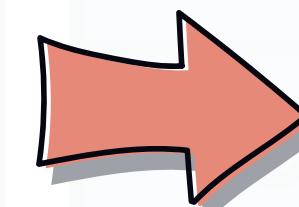
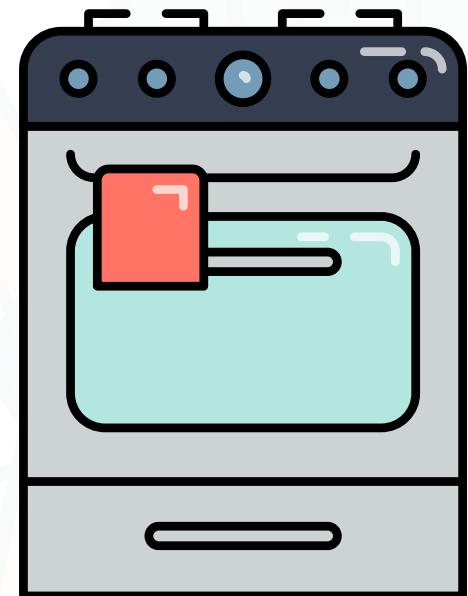


Input

Step 1



Step 2



Output

Analogy ≡

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

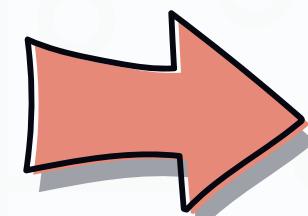
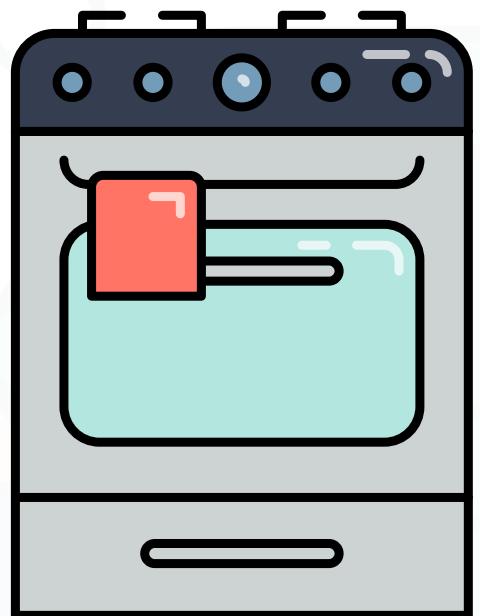


Input

Step 1



Step 2



Output

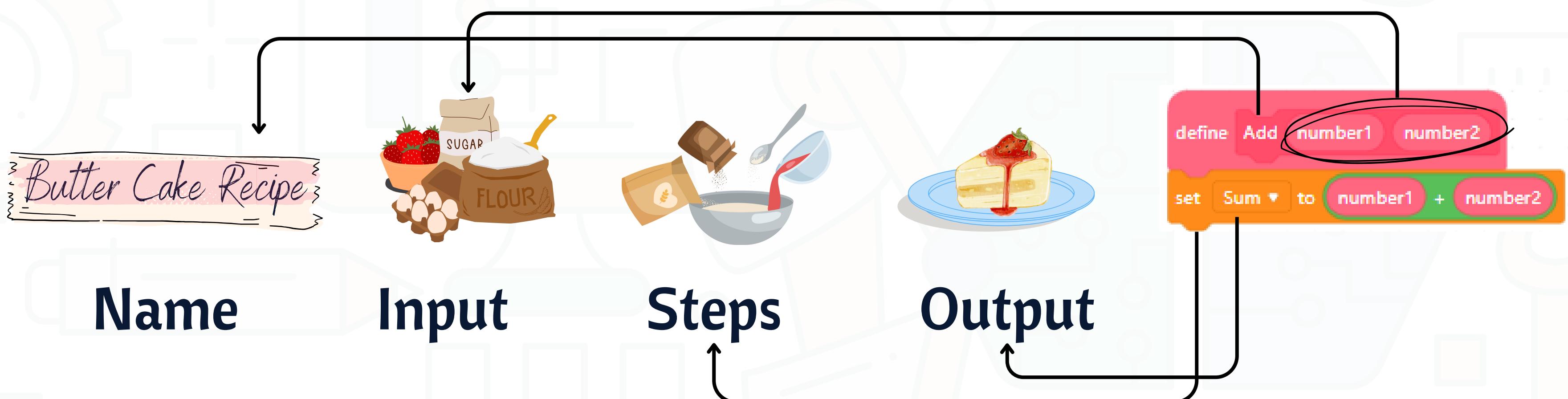
Think

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

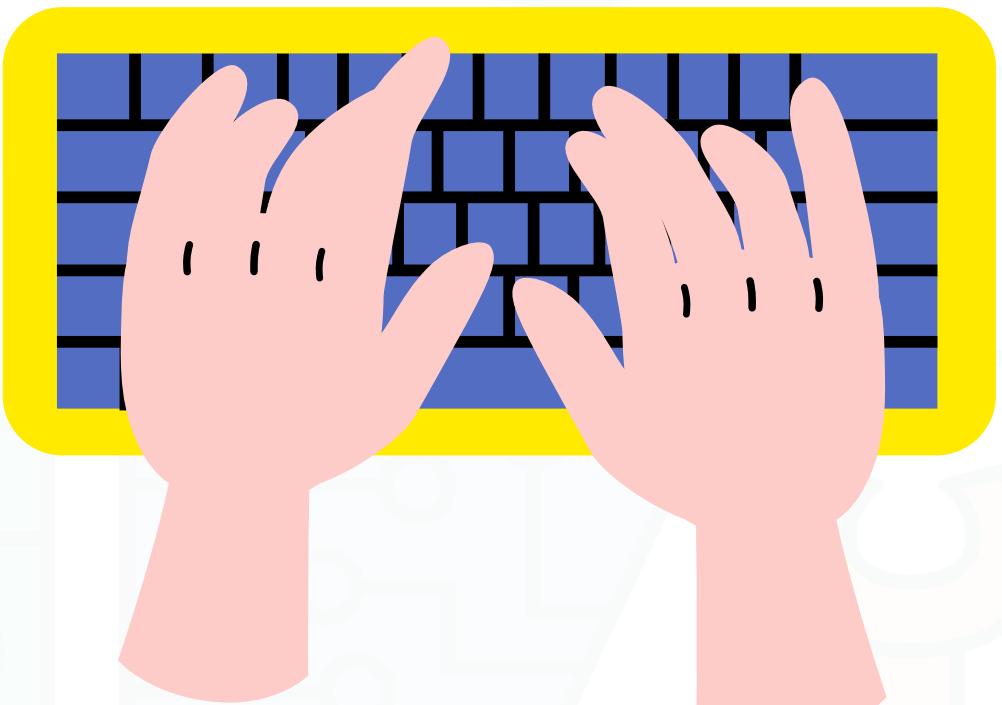


Write a code to move forward and backward

Try it by yourself



Hint: Use begin function to Define pins.

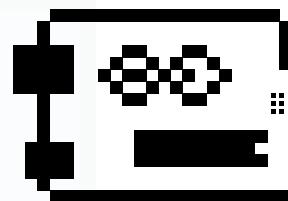


Let's try it on mBlock



Begin Function

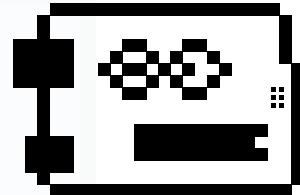
```
define begin
  set MotorBLS ▾ to 5
  set MotorFLS ▾ to 6
  set MotorBRS ▾ to 9
  set MotorFRS ▾ to 10
  set MotorBL1 ▾ to 7
  set MotorBL2 ▾ to 8
  set MotorFL1 ▾ to 11
  set MotorFL2 ▾ to 12
  set MotorBR1 ▾ to 13
  set MotorBR2 ▾ to 14
  set MotorFR1 ▾ to 15
  set MotorFR2 ▾ to 16
```



Let's try it on mBlock

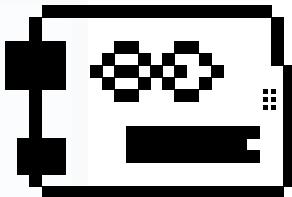
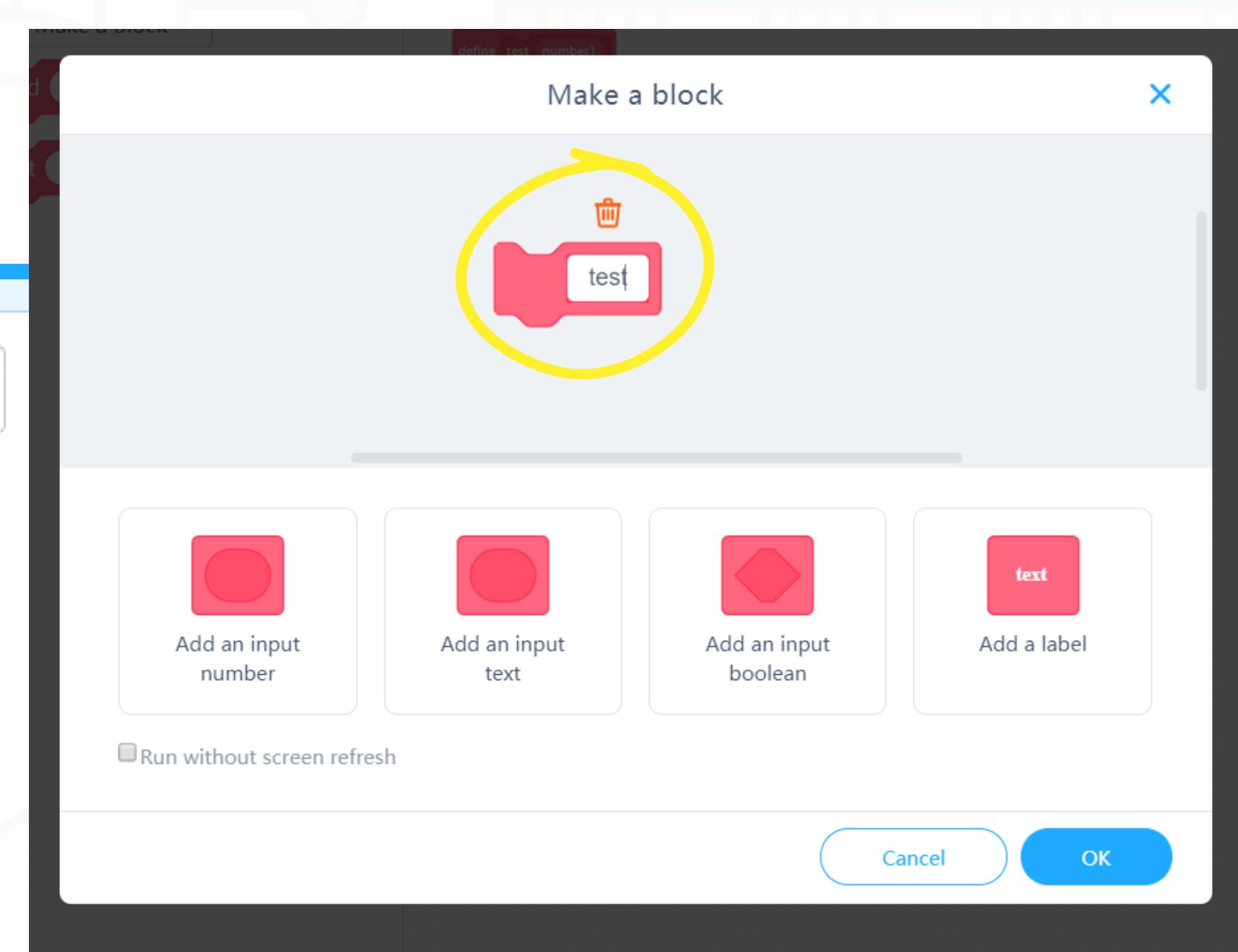
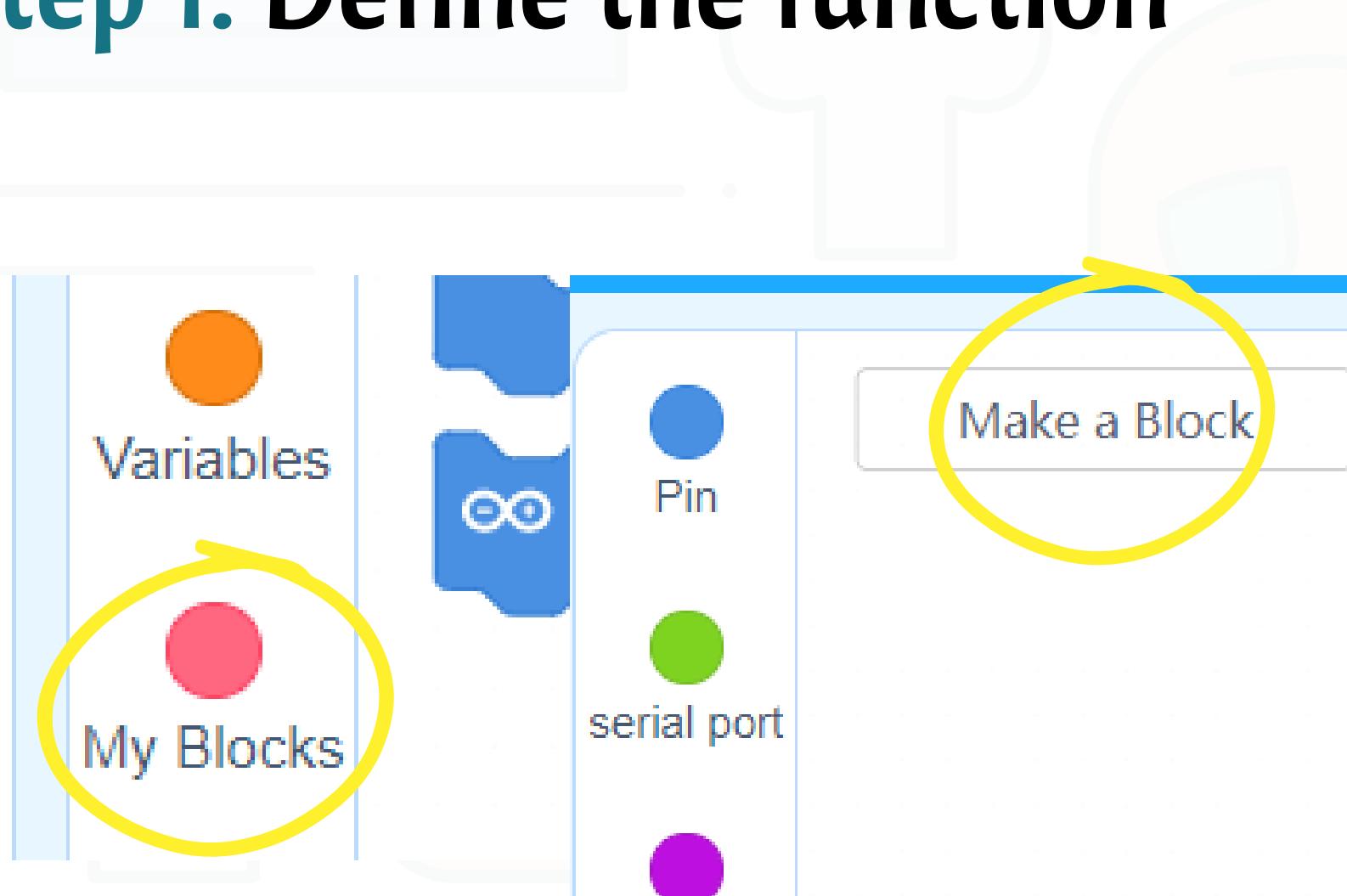


```
when Arduino starts up
begin
forever
    Forward 170
    wait 5 seconds
    Stop
    Backward 170
    wait 5 seconds
    Stop
end
```



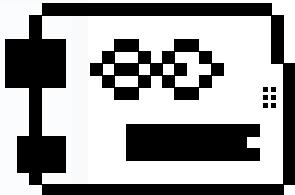
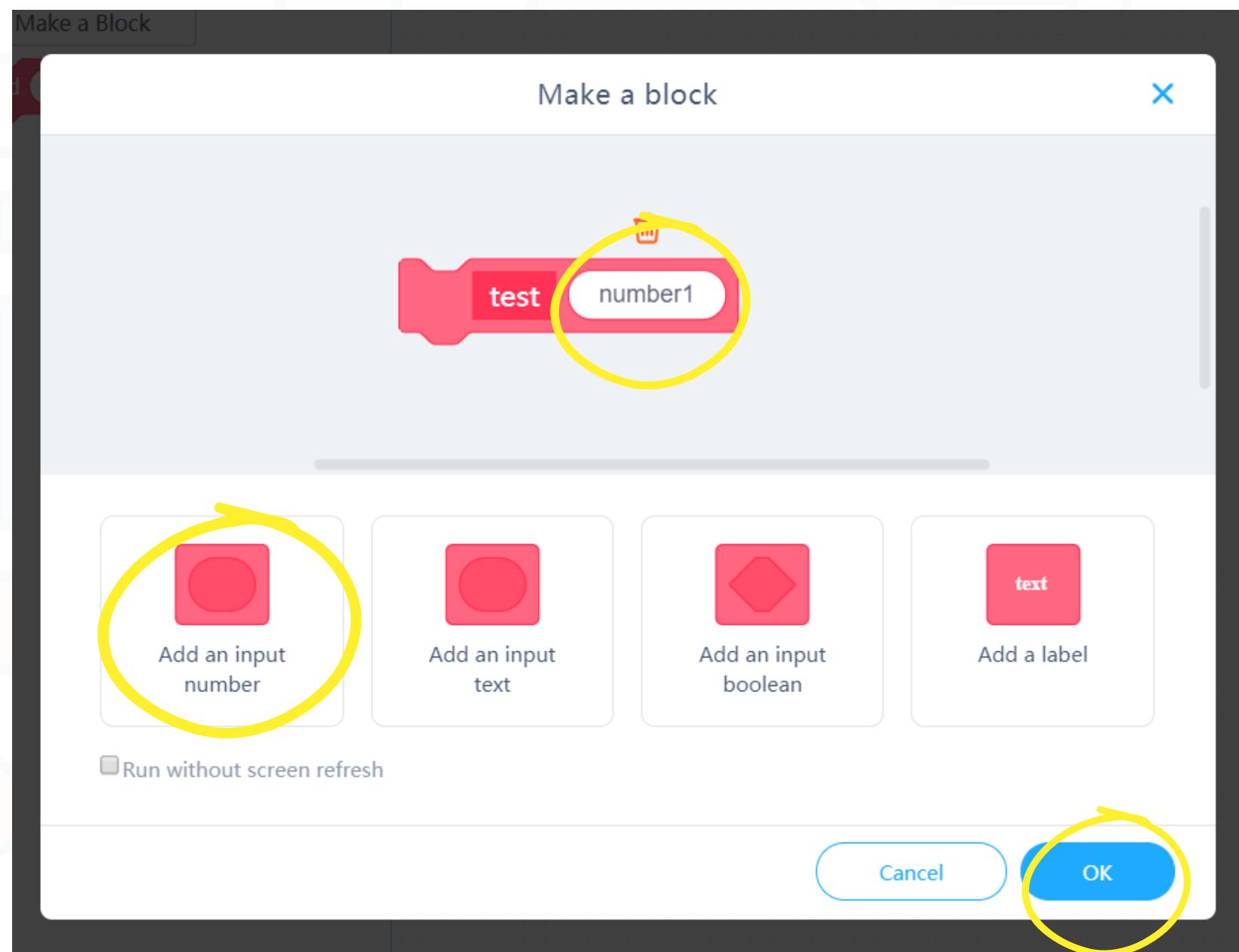
Let's make functions

Step 1: Define the function



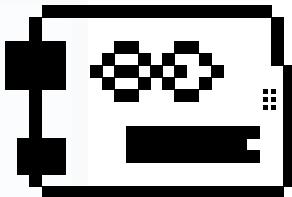
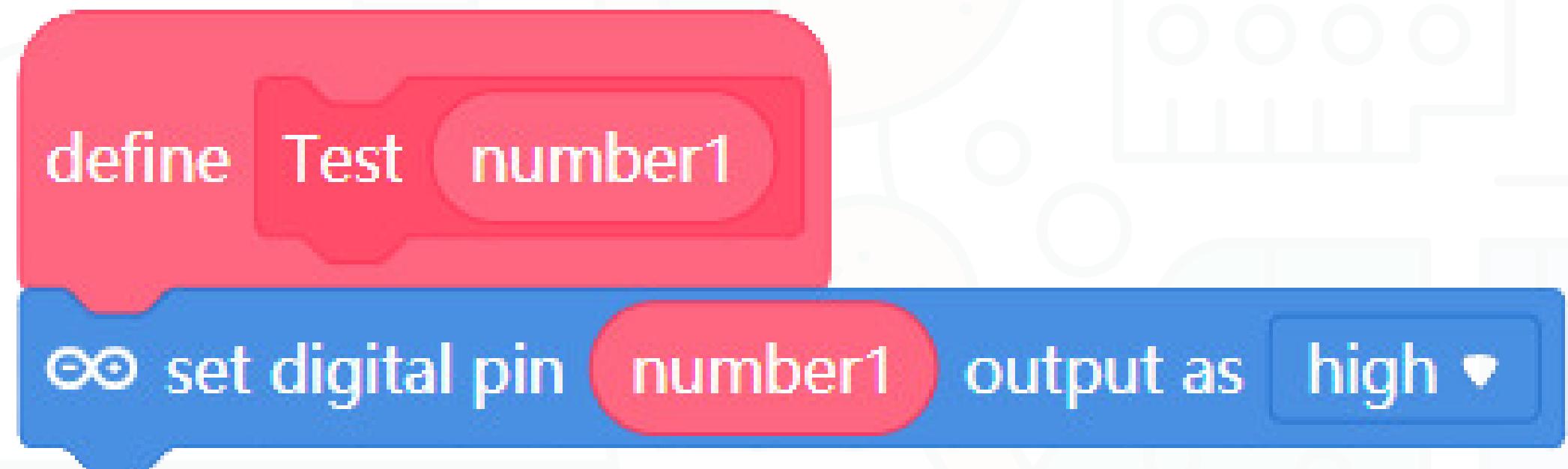
Let's make functions

Step 2: Define parameters



Let's make functions

Step 3: Build function block



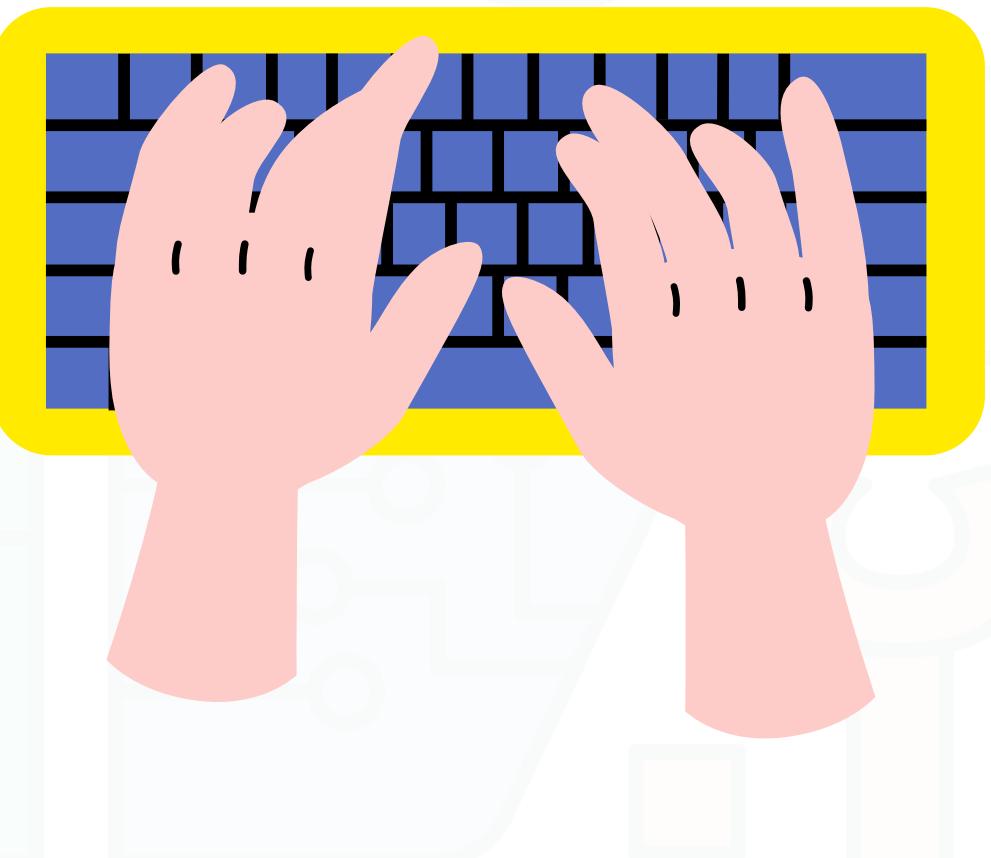
Let's try it on mBlock



Write a code to rotate as a function

Try it by yourself

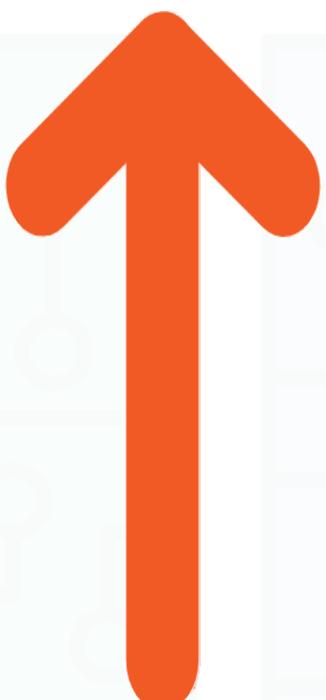
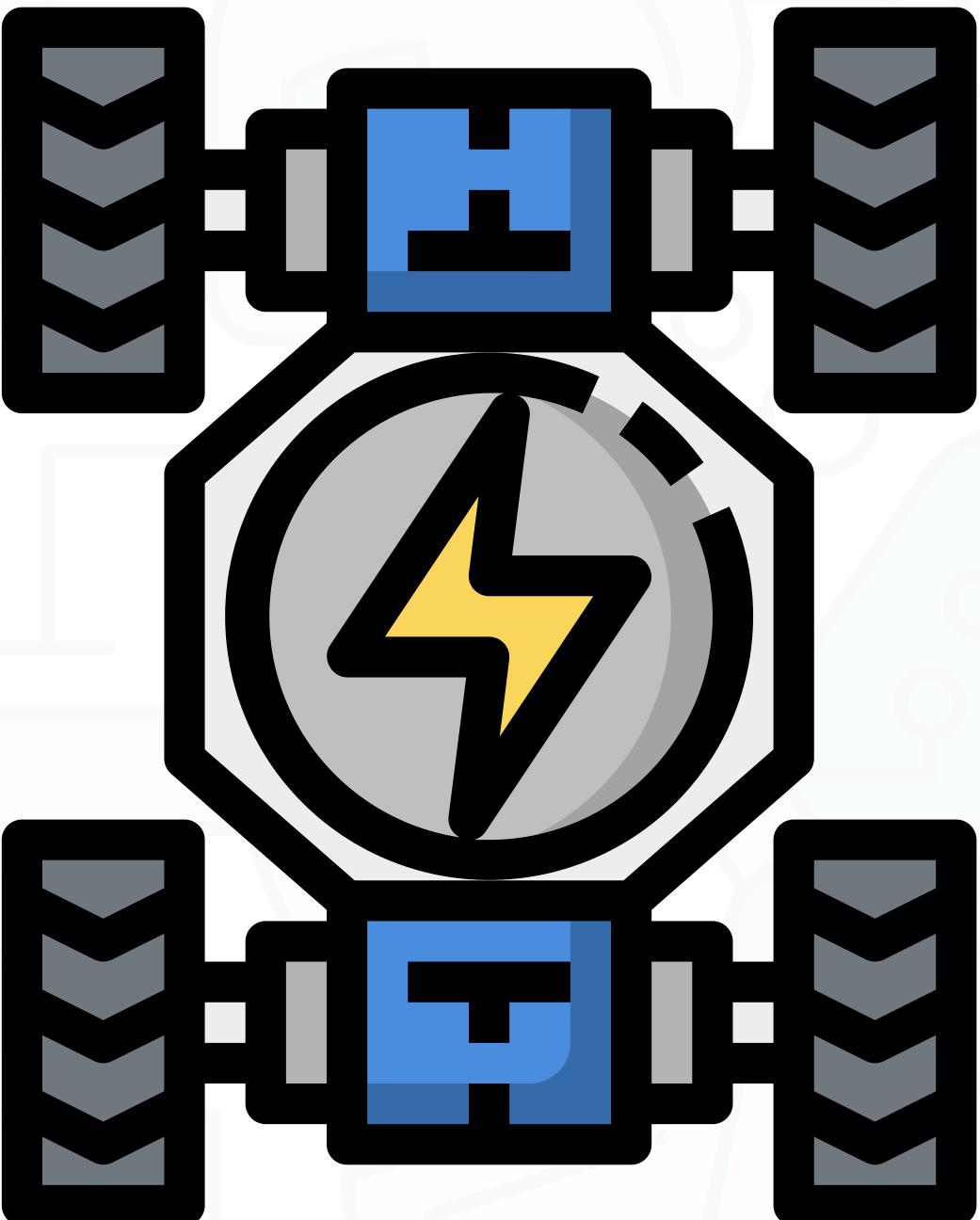
Hint: Use begin function to Define pins.



Rotate The Robot

Left Rotation

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



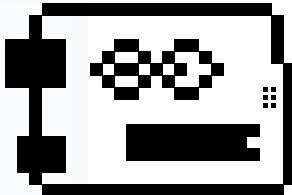
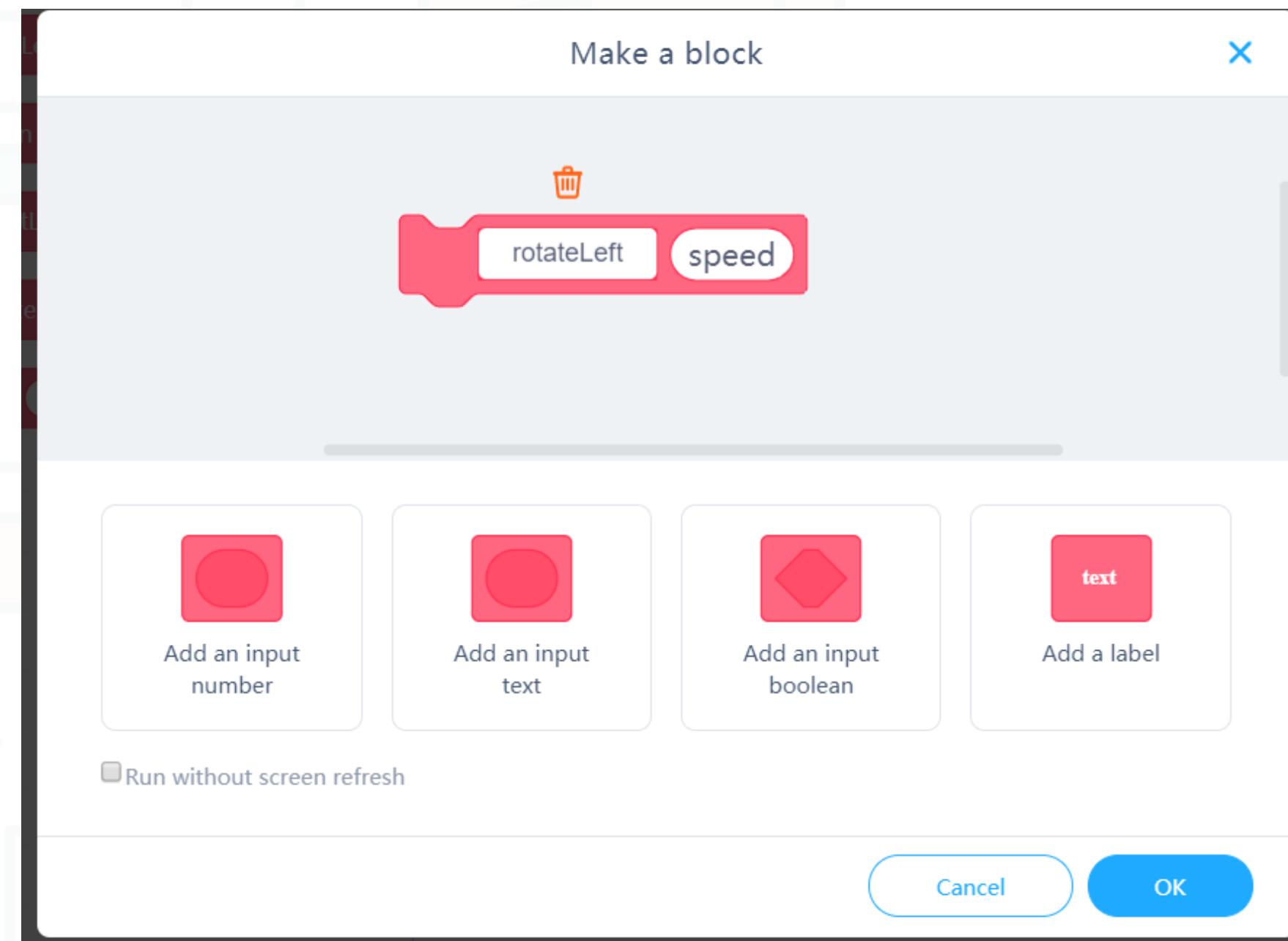
- Enable -> D10
- Input 1 -> A1(D15)
- Input2 -> A2(D16)

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

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

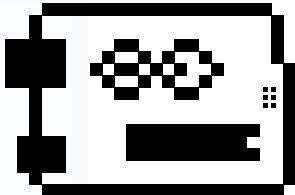
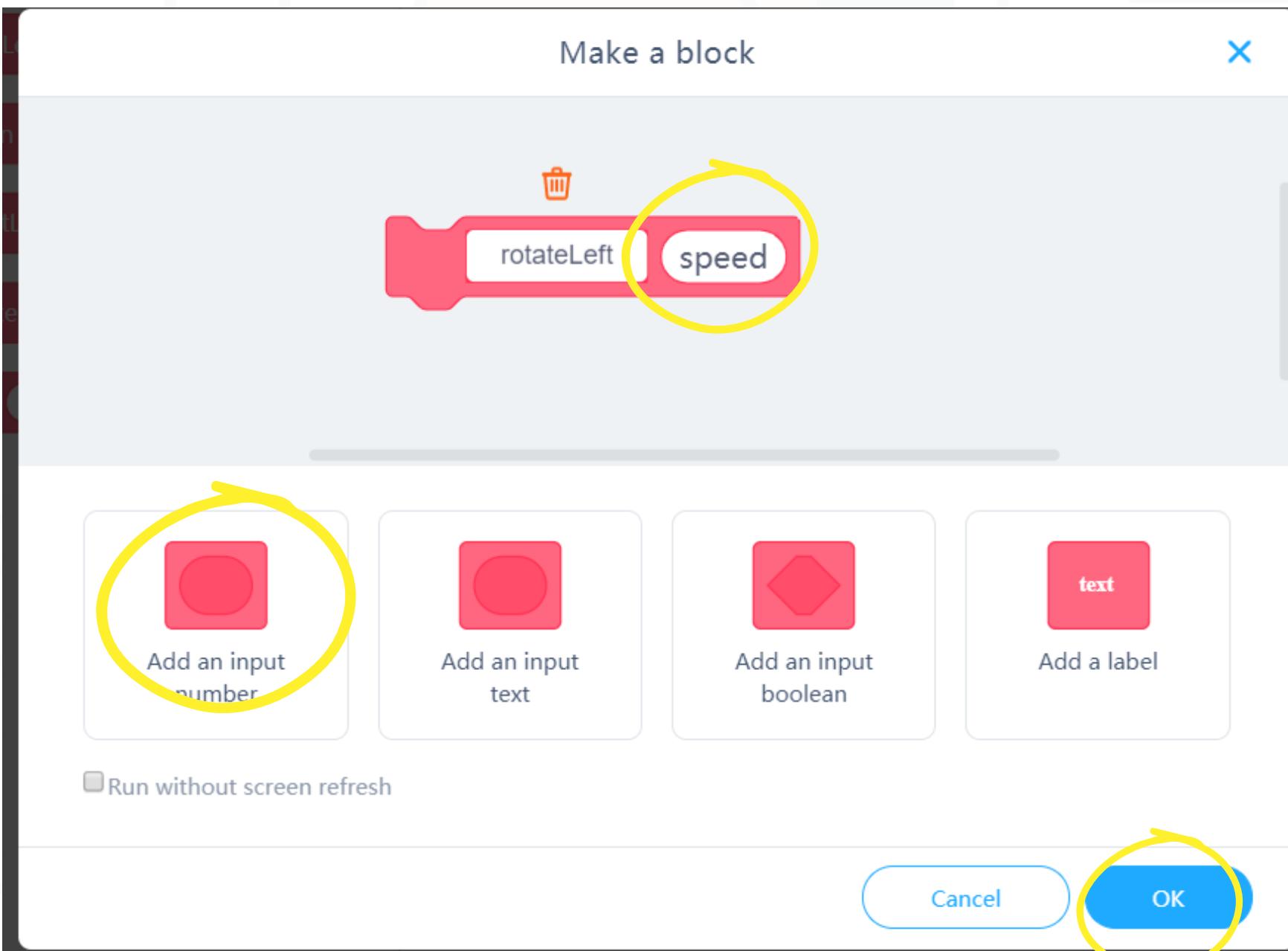
Let's make functions

Step 1: Define the function



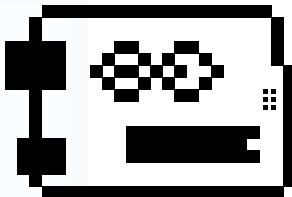
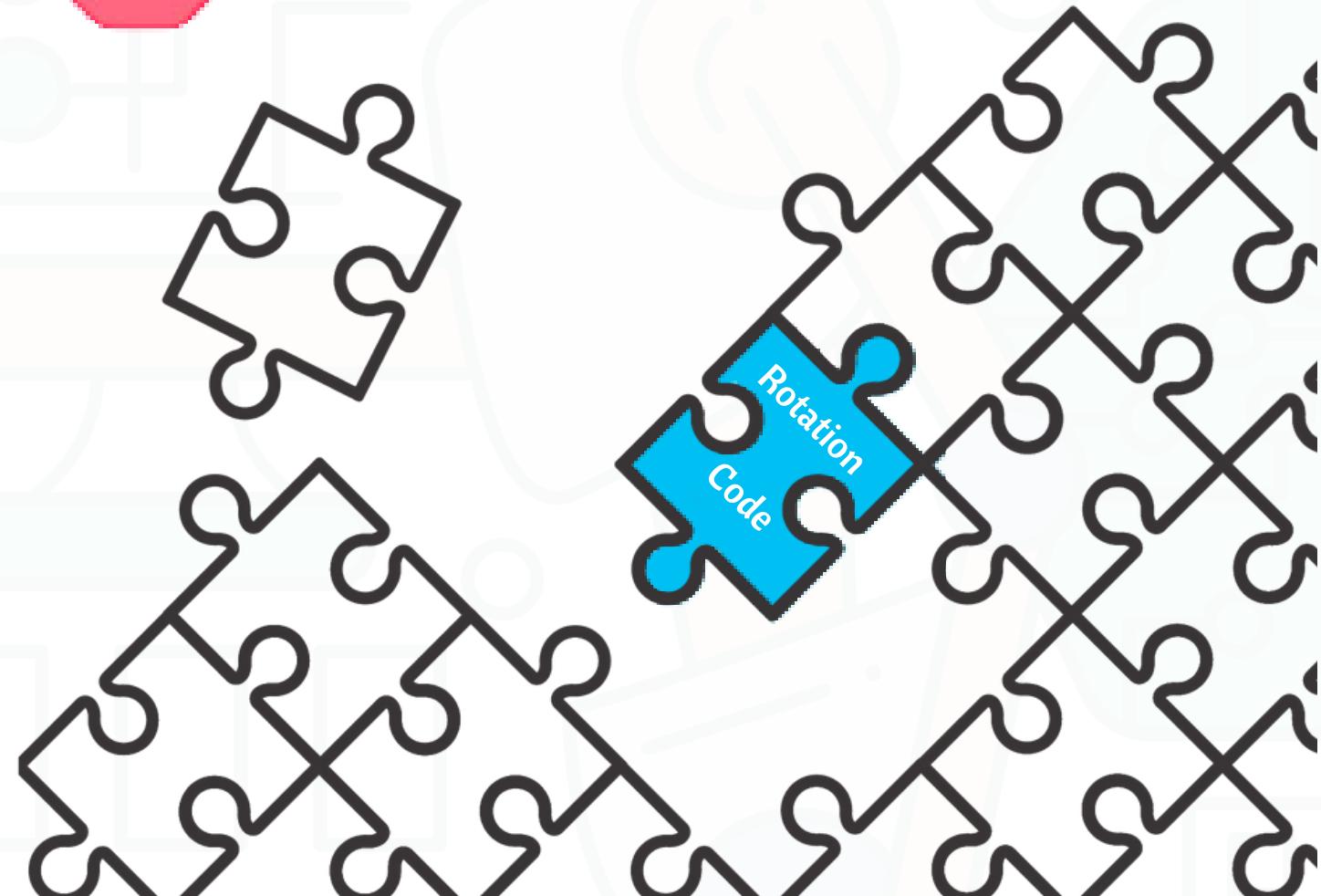
Let's make functions

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

