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Cache Code Math: Fractions, Functions, & For-Loops Preparatory Materials

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Instructional Resource
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Abstract
These instructional guides are used in the 5th-grade computer labs in conjunction with JavaScript/CodeHS. Computer Lab Specialists are provided with step-by-step instructions to review with students how to use functions and for-loops. These lessons support learning the following CS ideas: repeat/for, functions, algorithmic thinking, and abstraction. These preparatory activities are meant to be delivered before the "Cache Code Math: Fractions, Functions, & For-Loops."

Karel Runs Laps
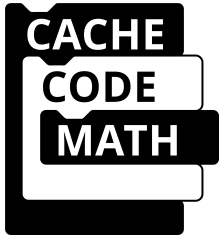
Lesson Overview

This optional lesson supports students learning about functions and for-loops within a codeHS/javascript program by writing a program for Karel to run laps around the world. This lesson supports learning the following CS ideas: repeat/for-loops, functions, algorithmic thinking, and abstraction.

Learning Objective

I can use functions and for-loops to have Karel run laps.

Timing & Sequence

*Teach **before** Karel Cleans Up & Karel at the Dog Park*

20 minutes total (½ of class time)
- 2 minutes- Sign into computer/codeHS
- 8-10 minutes- Teacher demonstration with students watching or "follow the leader" with teacher demonstrating and students following along in codeHS.
- 10 minutes- Students' coding task

Resources

- For-loops poster

Karel Runs Laps

CACHE CODE MATH

Teacher Demonstration

We want to see how fast Karel can run 10 laps around the world with our code on "fast." We can use a for-loop to help us. A for-loop does a repeated sequence in our code.

First, we create a function for Karel to run **one length** (side) of the world. The world is 10 x 10 with Karel starting in row 1, avenue 1 (1, 1). Then we will add our for-loop within our sideLength function. Remember, Karel only needs to move **nine** more spaces to get to the end of the row because Karel is already on the first space (1, 1).

```
function sideLength(){
    for (var i = 0; i < 9; i++) {
        move();
    }
}
```

```
12 - function sideLength(){
13 -     for (var i = 0; i < 9; i++) {
14          move();
15      }
16 }
```

Karel Runs Laps

Next, we create a for-loop for Karel to run 10 laps around the world using the "sideLength" function we created. We will put a 10 in the "i < COUNT" (index or loop control variable) to tell Karel to repeat the "sideLength(), turnLeft()" sequence 10 times.

How many times do we need to place our "sideLength(), turnLeft()" sequence within our for-loop? (Students' response: Four times!) Karel's world is a square which means there are four equal sides. Karel will run the length (side) and then turn left to run the next side of the square. There are four sides so we will do this four times.

```
1   // This function will have Karel run 10 laps.
2   function start () {
3       for ( var i = 0; i < 10; i++ ) {
4           sideLength ( );
5           turnLeft ();
6           sideLength ( );
7           turnLeft ();
8           sideLength ( );
9           turnLeft ();
10          sideLength ( );
11          turnLeft ();
12      }
13  }
14  // This function will have Karel run one side of the world.
15  function sideLength () {
16      for ( var i = 0; i < 9; i++ ) {
17          move ();
18      }
19  }
20  //Challenge:
21  /* Karel ran 10 laps in 25 seconds!
22  *How many laps can Karel run in 2 minutes at fast speed?*/
```

Let's see how fast Karel runs ten laps. (Use a timer on your phone or computer). It took Karel about 25 seconds to run 10 laps on fast speed. Good job Karel!

Karel Runs Laps

```
1   // This function will have Karel run 10 laps.
2 ▾ function start(){
3 ▾     for (var i = 0; i < 10; i++) {
4           sideLength();
5           turnLeft();
6           sideLength();
7           turnLeft();
8           sideLength();
9           turnLeft();
10          sideLength();
11          turnLeft();
12      }
13  }
14  // This function will have Karel run one side of the world.
15 ▾ function sideLength(){
16 ▾     for (var i = 0; i < 9; i++) {
17          move();
18      }
19  }
20  //Challenge:
21  //Karel ran 10 laps in 25 seconds!
22  //How many laps can Karel run in 2 minutes at fast speed?
```
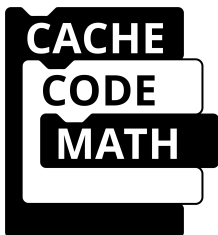
Student Task Option A

How many laps can you get Karel to run on fast speed in 2 minutes?

(Students will change the index value to change the number of laps.)

Student Task Option B (Advanced)

Can you find another place in our code to use a for-loop to make our code even more efficient?

(Students can have Karel run one lap by putting the sideLength() and turnLeft() commands within a for-loop and **renaming the variable i to "side" in the nested for-loop.**)

```
2   function start () {
3       for ( var i = 0; i < 10; i++) {
4           for ( var side = 0; side < 4; side+) {
5               sideLength ();
6               turnLeft ();
7           }
8       }
9   }
```

Tennis Ball Pick Up
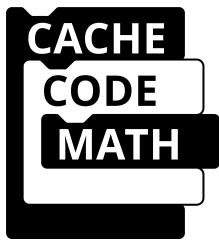
Lesson Overview

This optional lesson supports students learning about functions and for-loops within a codeHS/javascript program by writing a program for Karel to pick up tennis balls. This lesson supports learning the following CS ideas: repeat/for, functions, algorithmic thinking, and abstraction.

Learning Objective

I can use functions and for-loops to help Karel pick up tennis balls.

Timing & Sequence

*Teach **before** the Karel Cleans Up & Karel at the Dog Park lessons*

20 minutes total (½ of class time)
- 2 minutes- Sign into computer/codeHS
- 8-10 minutes- Teacher demonstration with students watching. Students may follow along with "Follow the Leader" sandbox.
- 10 minutes- Students' coding task
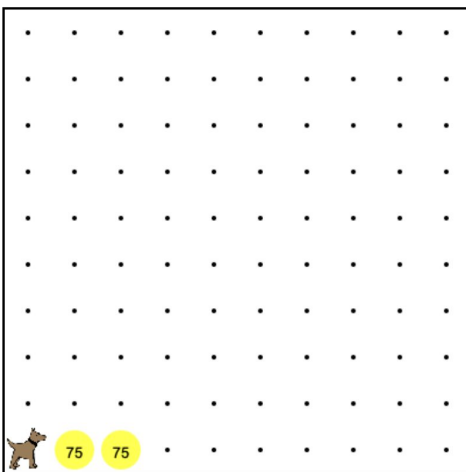
Resources

- [For-loops poster](#)
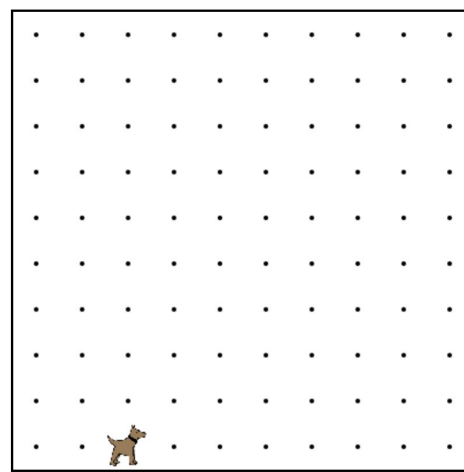
Tennis Ball Pick Up

CACHE CODE MATH

Teacher Demonstration

There are two stacks of 75 tennis balls in front of Karel. We will write code that directs Karel to move to the stack, pick up all of the tennis balls, and then move to the next stack. We will define a function named "pickUp()" and use a for-loop.

Starting World

Ending World

First, let's define a function named "pickUp"


```
1  // Write your code here
2  function start(){
3
4  }
5  function pickUp(){
6
7  }
```

Tennis Ball Pick Up

Next, we want Karel to pick up 75 tennis balls. We can use a for-loop to have Karel repeat the takeBall command 75 times. We will change the "i < COUNT" to "i < 75" to do this.

```
1   // Write your code here
2   function start(){
3
4   }
5   function pickUp(){
6   for (var i = 0; i < 75; i++) {
7   takeBall();
8   }
9   }
```

Lastly, we can call our function and add the move commands to our start function to help Karel pick up tennis balls! We will first add a comment telling us what our start function does. Then, we will add a move command to get Karel to the first stack of tennis balls, pick them up, and move to the next stack to pick up the tennis balls.

```
1   // Write your code here
2   function start(){
3   // Karel picks up two piles of 75 tennis balls.
4   move();
5   pickUp();
6   move();
7   pickUp();
8   }
9   function pickUp(){
10   for (var i = 0; i < 75; i++) {
11   takeBall();
12   }
13   }
```
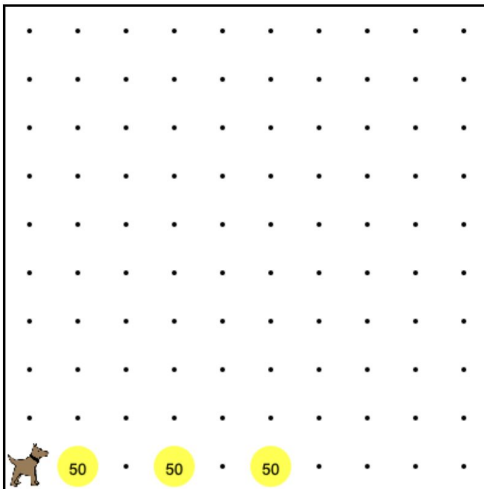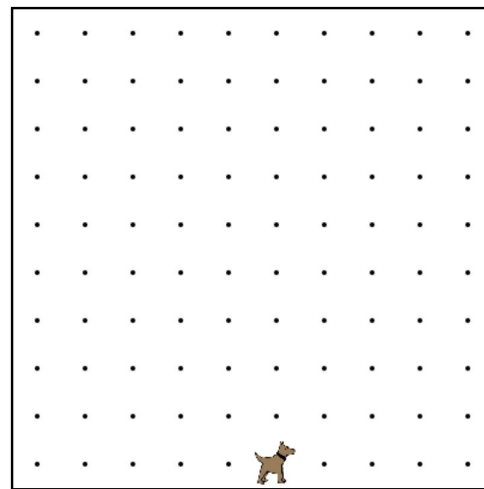
# Tennis Ball Pick Up
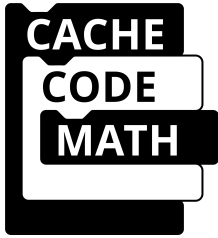
**Student Task**

There are three stacks of 50 tennis balls in front of Karel. Have Karel move to the stack, pick up all of the tennis balls, and then move to the next stack. Repeat until all the balls are picked up. Define a function named "pickUp()" and use a for-loop!

**Starting World**

**Ending World**

## Solution

```
1    // Write your code here
2    function start(){
3        // Karel picks up three piles of 50 tennis balls.
4        move();
5        pickUp();
6        move();
7        move();
8        pickUp();
9        move();
10       move();
11       pickUp();
12   }
13   function pickUp(){
14       for(var i = 0; i < 50; i++){
15           takeBall();
16       }
17   }
```

```
1    // Write your code here
2    function start(){
3        // Karel picks up three piles of 50 tennis balls.
4        move();
5        pickUp();
6        move();
7        move();
8        pickUp();
9        move();
10       move();
11       pickUp();
12   }
13   function pickUp(){
14       for(var i = 0; i < 50; i++){
15           takeBall();
16       }
17   }
```