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

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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 and tutorial videos to teach students how to use functions and for-loops to write programs for Karel the Dog to model multiplying fractions. These lessons support learning the following CS ideas: repeat/for, functions, algorithmic thinking, and abstraction. These activities are meant to be delivered after the "Fractions, Functions, & For-Loops: Preparatory Activities" and in conjunction with the mathematics lesson plans, "Cache Code Math: Fractions Unit."

Acknowledgment

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Karel Cleans Up

Lesson Overview

This lesson supports students in understanding how to multiply a fraction by a whole number by creating a program using functions and for-loops within a codeHS/javascript program. This lesson supports learning of the following CS ideas: repeat/for-loops, functions, algorithmic thinking, and abstraction.

Learning Objective

I can use functions and for-loops to create a multiplication model in codeHS.

Timing & Sequence

*Teach **before** the Karel at the Dog Park activity.*
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

- Instructor video explaining math & coding concepts.
  - Multiply a whole number by a fraction 0:00-2:51
  - Functions 2:51-3:53
  - For-loops 3:53- 5:30
  - Karel Cleans Up demo 5:30-end
- "Follow the Leader" video for students to view and follow along (replaces teacher demonstration part of lesson).
- "For-loops" poster

Karel Cleans Up

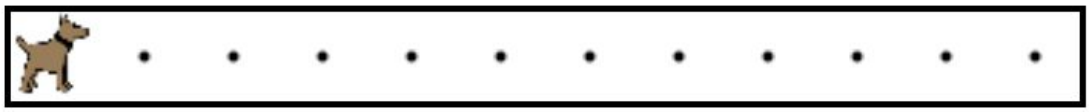
CodeHS Sandbox Links
***Teacher Demo*:** https://codehs.com/sandbox/id/karel-cleans-up-demonstration-JYEUNN
Follow the Leader: https://codehs.com/sandbox/id/karel-cleans-up-student-follow-the-leader-IVEtef
Student Task: https://codehs.com/sandbox/id/fractions-karel-cleans-up-student-M7MCv4
***Student Task Solution*:** https://codehs.com/sandbox/id/fractions-karel-cleans-up-solution-KCWnU8

CACHE CODE MATH

Teacher Demonstration

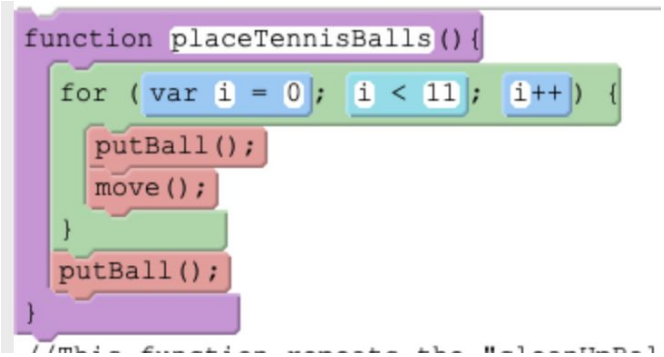
Create a function that has Karel place 12 tennis balls in the row. Next, have Karel clean up half (½) of the 12 tennis balls. Use a for-loop! How many tennis balls does Karel need to clean up?

Starting World



Ending World

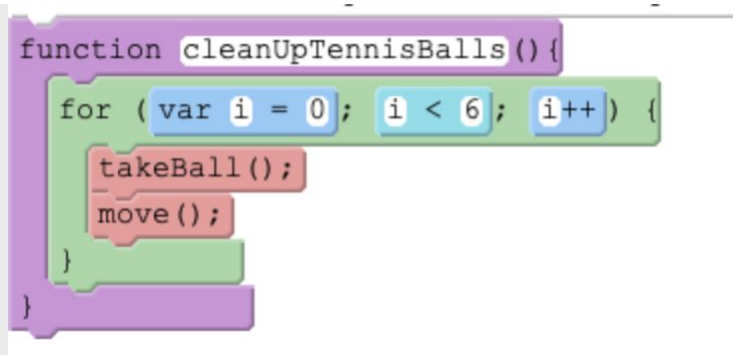
First, we need to create a function "placeTennisBalls" for Karel to place 12 tennis balls. To place 12 tennis balls, we will put the number 11 in the loop index variable (i < COUNT). We will need to add one more "putBall" command because Karel won't be able to move after placing the tennis ball the 11th time. This is because our world is only 12 units wide and Karel will run into the wall since there are only 11 places for Karel to move.




```
function placeTennisBalls(){
    for (var i = 0; i < 11; i++) {
        putBall();
        move();
    }
    putBall();
}
```

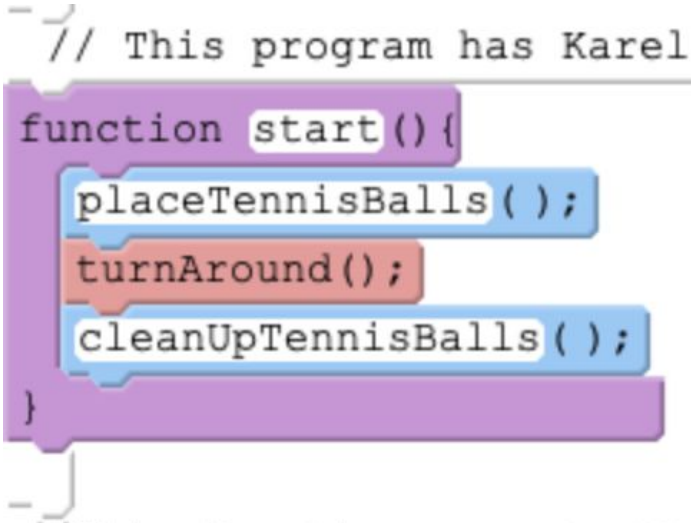
Karel Cleans Up

Next, we need to create a function “cleanUpTennisBalls” with a for-loop to tell Karel how many tennis balls to clean up. If we want Karel to clean up half of the 12 tennis balls, how many should Karel clean up? What is 12 x ½ ? (Answer: 6). We will use the takeBall and move commands in our function.




```
function cleanUpTennisBalls(){
    for (var i = 0; i < 6; i++) {
        takeBall();
        move();
    }
}
```

Next, we need to call our placeTennisBalls function inside our start function and give Karel directions to turn around. Then, we call our cleanUpTennisBalls function.



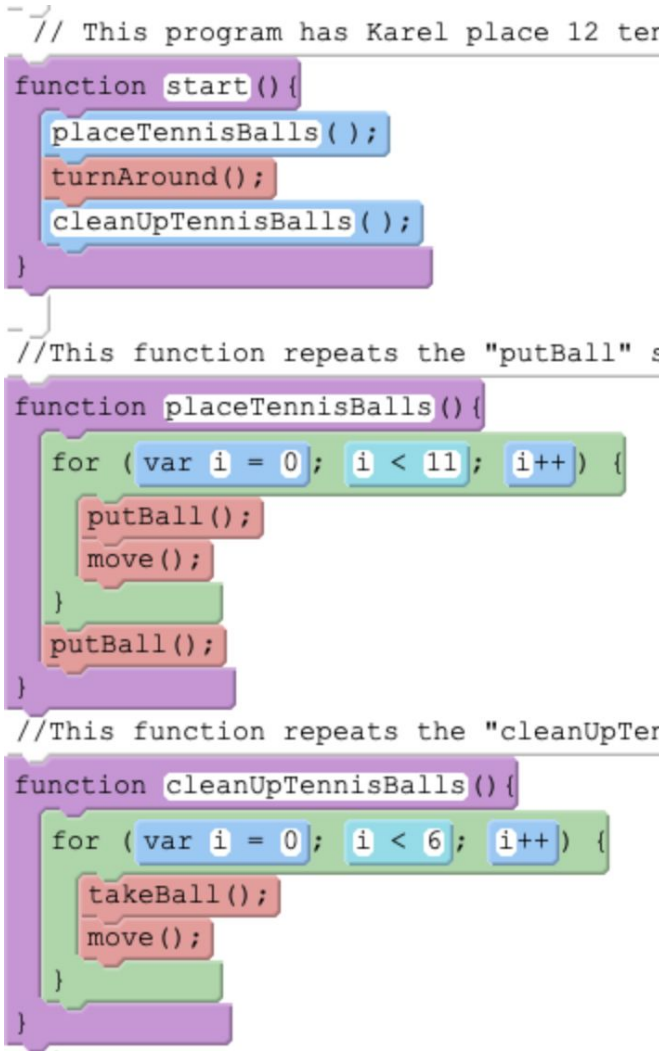

```
// This program has Karel place 12
function start(){
    placeTennisBalls();
    turnAround();
    cleanUpTennisBalls();
}
```

Now, that our code is all put together let’s run the code to make sure it works!

Karel Cleans Up

Full code

Note: The comments are cut off in the screenshots below. Full comments can be found in the codeHS demonstration sandbox.




```
 // This program has Karel place 12
function start(){
    placeTennisBalls();
    turnAround();
    cleanUpTennisBalls();
}

//This function repeats the "putBall
function placeTennisBalls(){
    for (var i = 0; i < 11; i++) {
        putBall();
        move();
    }
    putBall();
}
//This function repeats the "cleanUp
function cleanUpTennisBalls(){
    for (var i = 0; i < 6; i++) {
        takeBall();
        move();
    }
}
```

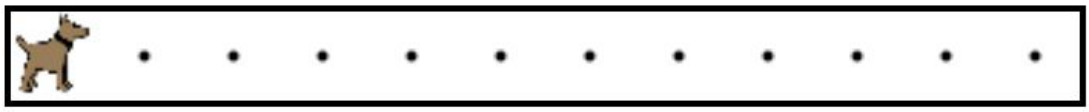
Karel Cleans Up

CACHE CODE MATH

Student's Coding Task

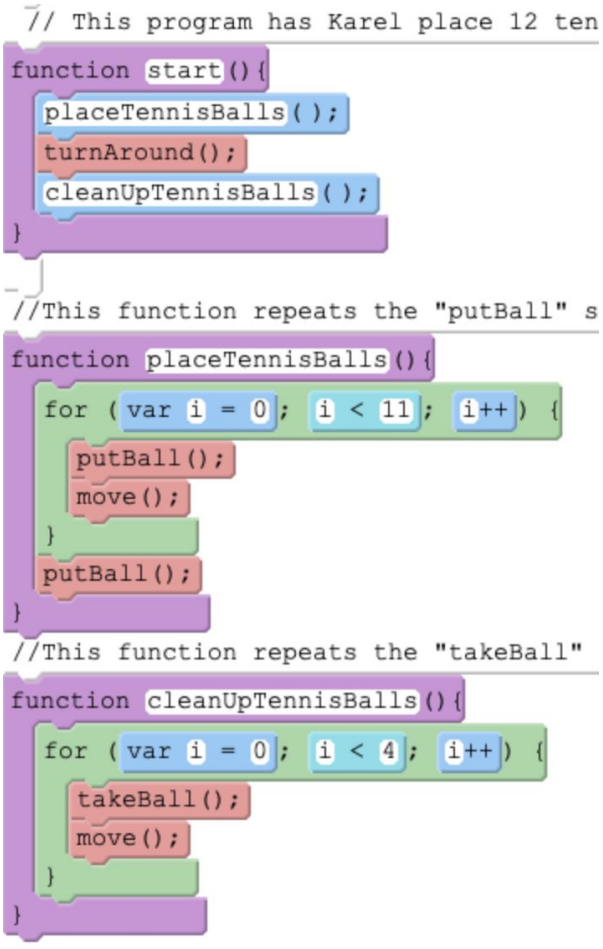
Create a function that has Karel place 12 tennis balls in the row. Then, have Karel clean up one-third (⅓) of the 12 tennis balls. Use a **for-loop**! How many tennis balls does Karel need to clean up?

Starting World



Ending World

Solution




```
// This program has Karel place 12 te
function start(){
    placeTennisBalls();
    turnAround();
    cleanUpTennisBalls();
}

//This function repeats the "putBall"
function placeTennisBalls(){
    for (var i = 0; i < 11; i++) {
        putBall();
        move();
    }
    putBall();
}
//This function repeats the "takeBall'
function cleanUpTennisBalls(){
    for (var i = 0; i < 4; i++) {
        takeBall();
        move();
    }
}
```

Karel at the Dog Park

Lesson Overview

This lesson supports students in understanding how to multiply fractions by creating a program using for-loops within a codeHS/javascript program. This lesson supports learning of the following CS ideas: repeat/for-loops, functions, algorithmic thinking, and abstraction.

Learning Objective

I can use for-loops to create a multiplication model in codeHS.

Suggested timing & sequence:

*Teach **after** the Karel Cleans Up activity.*

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 complete the student coding task in codeHS

Resources

- Instructor video explaining math & coding concepts.
  - Math concept 0:00-2:21
  - For-loops 2:21-3:32
  - codeHS- demonstration of activity 3:38-end
- "Follow the Leader" video for students to view and follow along (replaces teacher demonstration part of lesson).
- "For-loops" poster

Karel at the Dog Park

CodeHS Sandbox Links
Teacher Demo: https://codehs.com/sandbox/id/karel-at-the-dog-park-demonstration-tVFjCk
Follow the Leader: https://codehs.com/sandbox/id/karel-at-the-dog-park-follow-the-leader-YJhM23
***Student Task*:** https://codehs.com/sandbox/id/karel-at-the-dog-park-student-2O0aQS
Solution: https://codehs.com/sandbox/id/karel-at-the-dog-park-solution-KRjMAb

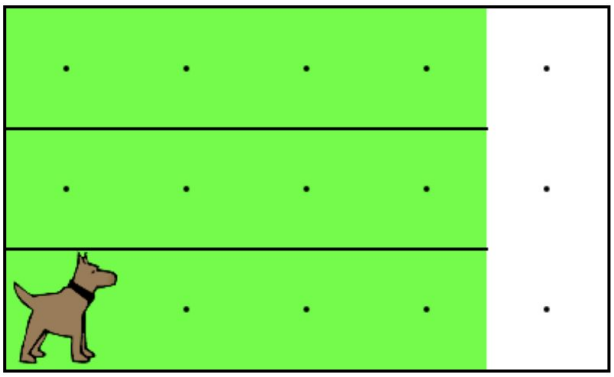
CACHE CODE MATH

Teacher Demonstration

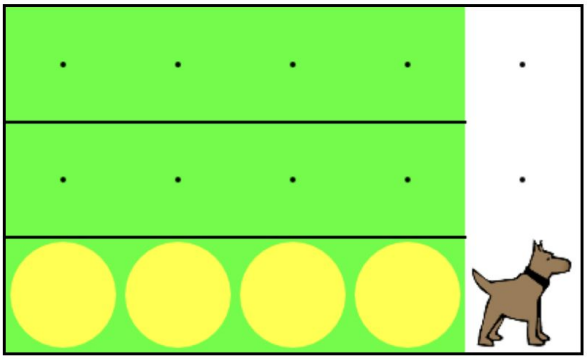
Only ⅛ of the park is open for doggie play with tennis balls. This is the green area in the world. Have Karel place tennis balls to cover ⅓ of the dog park open for play. Use a **for-loop**!

How many tennis balls will Karel place in the dog park? (Answer: 4)

Starting World



Ending World



Add a for-loop in the start function. Use the putBall and move commands. We want Karel to do this four times so we will change the loop index to "i < 4".

```
// Starts my code sequence.
function start(){
    // Repeats "putBall, move" sequence 4 times.
    for (var i = 0; i < 4; i++) {
        putBall();
        move();
    }
}
```

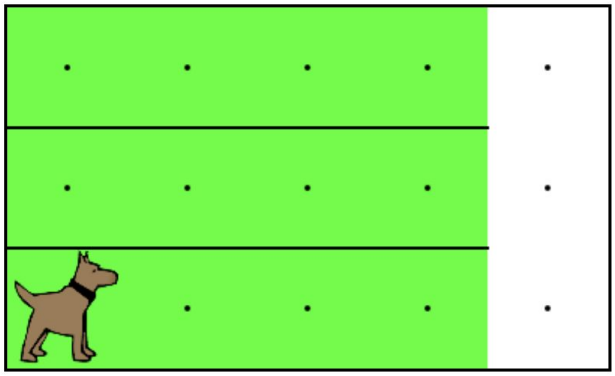
```
// Starts my code sequence.
function start(){
    // Repeats "putBall, move" sequence 4 times.
    for (var i = 0; i < 4; i++) {
        putBall();
        move();
    }
}
```

Karel at the Dog Park

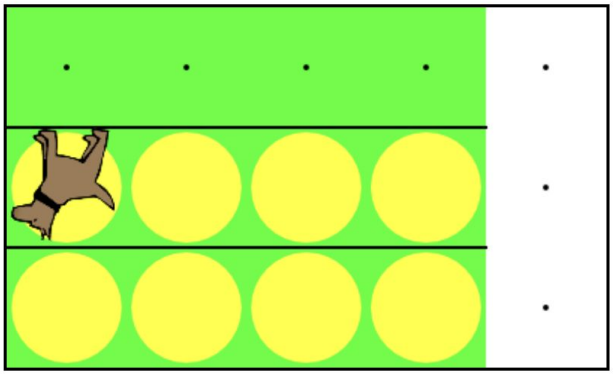
Student's Coding Task

Only ⅓ of the park is open for doggie play with tennis balls. This is the green area in the world. Have Karel place tennis balls to cover ⅔ of the dog park open for play with tennis balls. Use a **for-loop**! How many tennis balls will Karel place in the dog park?

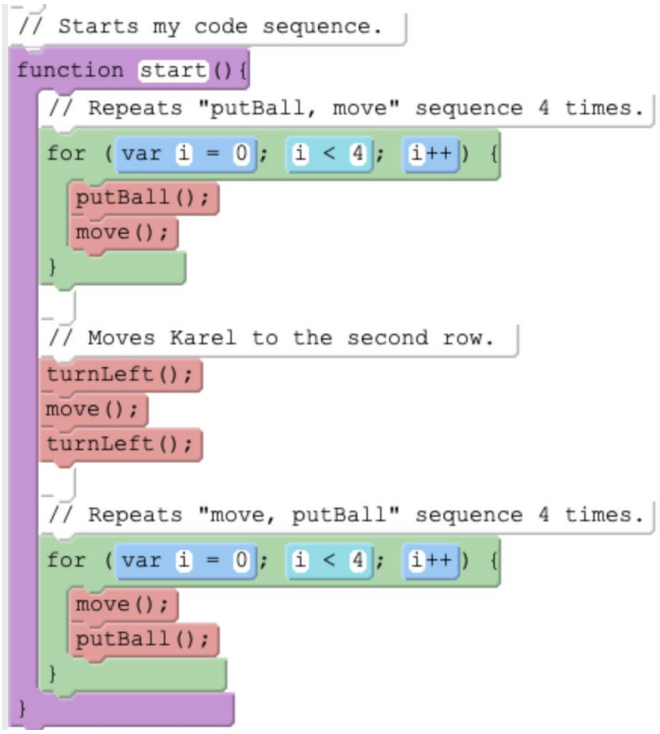
Starting World



Ending World



Solution




```
// Starts my code sequence.
function start(){
    // Repeats "putBall, move" sequence 4 times.
    for (var i = 0; i < 4; i++) {
        putBall();
        move();
    }

    // Moves Karel to the second row.
    turnLeft();
    move();
    turnLeft();

    // Repeats "move, putBall" sequence 4 times.
    for (var i = 0; i < 4; i++) {
        move();
        putBall();
    }
}
```