



## “Ice Cream Machine”



### Grade 8 Math Alignment

**Domain:** Geometry

**Cluster:** Solve real-world and mathematical problems involving volume of cylinders, cones and spheres

**Standard:** 8.G.9: Know the formulas for the volume of cones, cylinders, and spheres and use them to solve real-world and mathematical problems.

### Level 2 CSTA Alignment

**Concept:** Variables

**Standard:** 2-AP-11: Create clearly named variables that represent different data types and perform operations on their values

**Concept:** Modularity

**Standard:** 2-AP-13: Decompose problems and subproblems into parts to facilitate the design, implementation, and review of programs

**Standard:** 2-AP-14: Create procedures with parameters to organize code and make it easier to reuse

### Description

Students will program an ice cream machine to print ice cream cones with different numbers and sizes of ice cream scoops. They will work with **variables and modules** so that they'll be ready to print any order that comes their way. They will also use a **function** that calculates the cost of a particular ice cream cone based on the **volume** of the spherical ice cream scoops.

## Learning Objectives

- Students will think creatively about how to use variables and modules to create similar designs based on specifications
- Students will write a function to calculate cost using the volume formula of spheres
- Students will label and organize code to keep their program in order

## Videos

- Working with Code: <https://www.youtube.com/watch?v=YBRaaPGuO2E>
- Using Variables: <https://www.youtube.com/watch?v=l3OeE52zIns&t=5s>
- Modules Basics: <https://www.youtube.com/watch?v=U8jW-5YKPOA>
- Modules with Parameters: <https://www.youtube.com/watch?v=Us39lcENv4k>

## Review/Prior Knowledge

Students should be familiar with basic shapes in BlocksCAD and should be prepared to use comments, external inputs, disabled blocks, and collapsed blocks as needed to keep a clean workspace. This exercise uses modules with parameters, so familiarity with variables and basic modules may be useful, but is not necessary if time can be devoted to using this activity to introduce these concepts.

## Resources

- Student Handout: Ice Cream Machine → Student guide for activity
- Ice Cream Machine Solution.xml → Provides example solution

## Teacher Notes

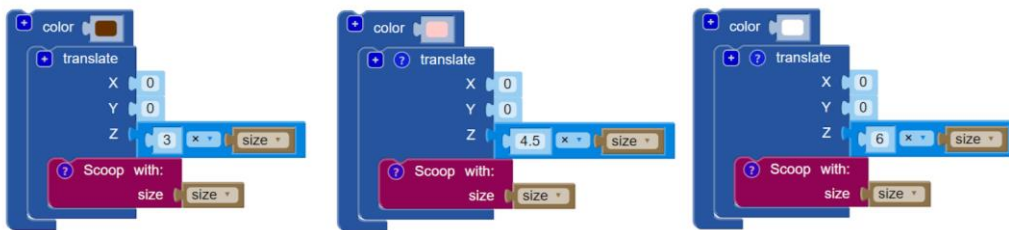
**General Introduction:** This activity uses the volume formula for a sphere, so students could be reminded of why volume is measured in cubic units and what needs to be known about a sphere to calculate its volume. The facilitator should be familiar with the solution provided so that they can help students get code that looks similar and accomplishes the same tasks.

**BlocksCAD Introduction/Refresher:** Students should be reminded about how to keep an organized workspace. They should be encouraged to experiment with variable and module blocks as they work through the activity, and should be warned to check in with

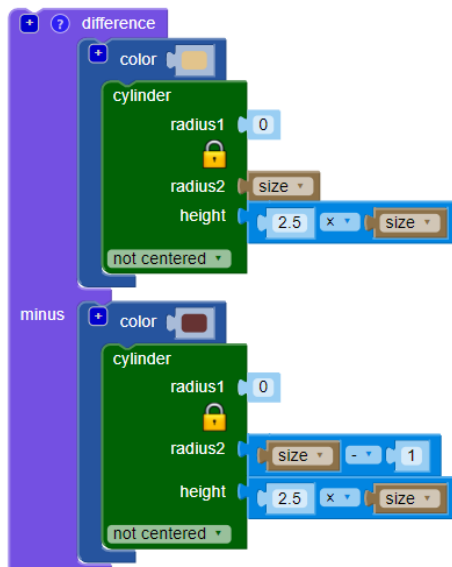
their facilitator at each checkpoint to make sure their code is operating properly before moving on.

**Exploration:** Students should be given time to work individually or in pairs to experiment with the task assigned in each section, but some elaboration on the hints provided may be required depending on the experience level of the class. See the solution .xml file provided for examples of how students can create the pieces of the ice cream cone and the formula for calculating price.

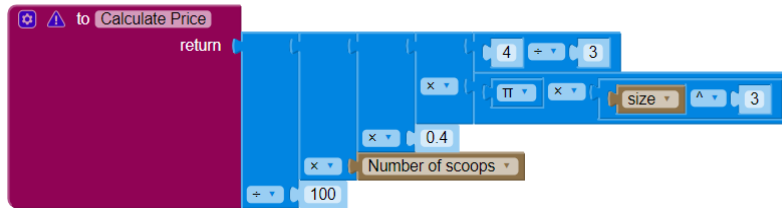
In **Part I**, the most challenging part is arranging the three scoops so that they line up nicely for each of the three possible sizes. The following example from the provided solution will line up the scoops nicely, but the most important thing is that students use the size variable to determine how far to move each scoop. The same is true in “Part II: Making the Cone”.



In **Part II** students design their cone. With a difference block and two cones blocks they should be able to make some slight adjustments so that their cone lines up nicely with their scoops:

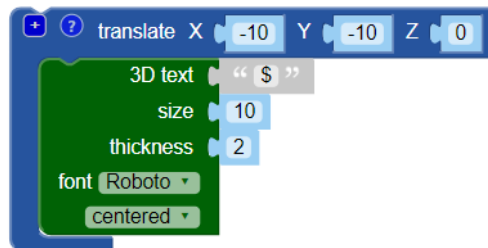


**Part III** walks students through the process of creating a pricing function. You can find the full solution in the solution BlocksCAD file, but students should end up with a function that looks like the one below:



Make sure that students are right-clicking the math blocks and selecting “External inputs” so that they can see all of these nested math blocks cleanly.

If they want to add a money sign in front of the cost, you can show them how to do something like:



Students will then be able to test their functions on particular ice cream orders. They are instructed to calculate at least one of the prices by hand to confirm that their function is working well.

- A large, double-scoop cone → \$5
- A medium, triple-scoop cone → \$4
- A small, triple-scoop cone → \$2

## Reflection Questions and Activities

1. What challenges might an ice cream store face if it really tried to automate the whole ice cream cone making process rather than leaving it to humans?
2. How could the ice cream machine theoretically add toppings to the ice cream and how would the pricing function take this into account?
3. Does increasing the size of the scoop or the number of scoops affect the cost more? Use specific examples to support your position.
4. Other BlocksCAD activities in the volume progression: Sugar Cubes, Witch's Cauldron, and Ice Cream Machine.
5. Other BlocksCAD activities in the modularity progression: Pizza Printer and Pythagoras on TV.