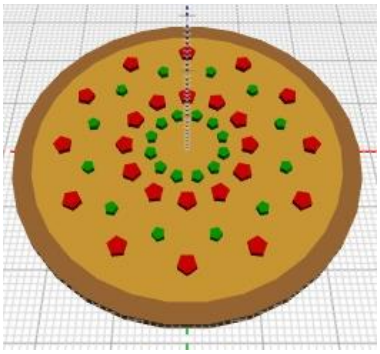
“Pizza Printer”



Grade 7 Math Alignment

Domain: Geometry
Cluster: Solve real-life and mathematical problems involving angle measure, area, surface area, and volume
Standard: 7.G.4: Know the formulas for the area and circumference of a circle and use them to solve 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-14: Create procedures with parameters to organize code and make it easier to reuse

Concept: Control
Standard: 2-AP-12: Design and iteratively develop programs that combine control structures, including nested loops and compound conditionals

Description

Students will code a **module** that can create a pizza, and then will incorporate a **variable** for size so that their “recipe” is adaptable to different pizza orders. They will answer questions about customers’ orders that have them calculate **circumference** and **area** of their pizzas. They will use **loops** and other creative design to add toppings to their pizza.

Learning Objectives

- Students will learn to use a module to store code that serves a defined purpose
- Students will make their modules adaptable by incorporating a variable that can take any prescribed value
- Students will practice calculating circumference and area of circles in the context of real world problems
- Students will use loops and their own creativity to add to an existing design

Videos

- Working with Code: https://www.youtube.com/watch?v=YBRaaPGuO2E
- Loops: https://www.youtube.com/watch?v=OQeyRl3j3FU
- Modules: https://www.youtube.com/watch?v=U8jW-5YKPOA

Review/Prior Knowledge

Students should be familiar with circle vocabulary like radius, diameter, circumference, and area. They should be familiar with the formulas that relate these quantities and will need to think creatively about how to get one quantity if they know the others. This activity assumes experience with basic BlocksCAD functionality like creating cylinders, translating objects, and adding comments to blocks. It is intended to introduce modules and reinforce the use of variables, and there is an optional section that allows students to practice using both simple and iterated loops.

Resources

- Student Handout: Pizza Printer → Student guide for activity
- Pizza Printer Solution.xml → Example blocks for teacher to examine

Teacher Notes

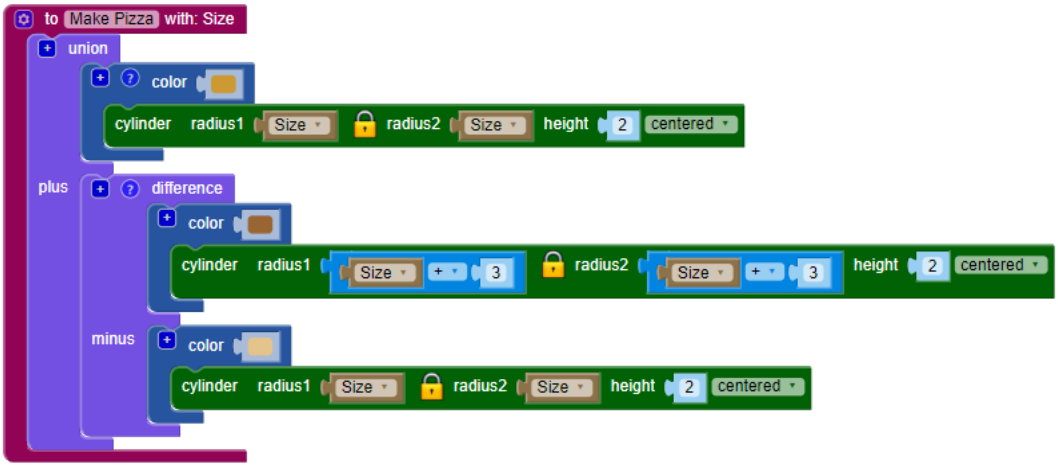
General Introduction: Have students individually and then collectively define the words radius, diameter, circumference, and area. Have students recall the formulas that relate these quantities, and remind them the significance of the symbol π.

BlocksCAD Introduction/Refresher: Students will have to use many of the different BlocksCAD menus throughout this activity, so remind them where they can find transformations like translations, color, and rotations. Make sure that students are comfortable labeling and collapsing code to keep their workspace organized.

Exploration: For **Part I**, the main part of the pizza can be made with a simple cylinder block. Making the crust requires copying the main pizza block and subtracting it from a

larger cylinder using a difference block. The instructor should emphasize the point made in the handout that the module alone will not make anything appear when students render. They need to actually pull out a block for “Make Pizza” so that the “recipe” they made gets followed.

In **Part II**, students will have to get a bit more creative about how to make their recipe adaptable to any size pizza they desire. Students should be continually reminded that the “Size” of the pizza refers to the radius of the main pizza, without the crust. This will make the code simplest when they go to incorporate the variable. Their code should look like:



The questions in **Part III** ask students to use the circle area and circumference formulas, so they will need calculators handy. You can have them use 3.14 for pi and they can round their answers. Encourage them to use correct units whenever necessary. Remind students that the word radius is used in these problems to describe the radius of just the main pizza. Solutions to each problem are provided below:

1) A customer orders a pizza that is 10 cm in radius. What is the diameter of the entire pizza, including the crust? Render this pizza with your printer and ensure that your answer looks accurate based on the BlocksCAD axis scales.

Diameter = 10 cm + 10 cm + 3 cm + 3 cm = 26 cm

What length of crust is on this pizza?

Circumference = π ● d = 3.14 ● 26 cm = 81.6 cm

2) One customer orders two pizzas that each have a radius of 15 cm. Another customer orders a pizza with a radius of 25 cm. Who ordered more pizza total (excluding crust)?

Customer 1 area = 2 ● (π ● r^2) = 2 ● (3.14 ● 15^2) = 1413 cm^2

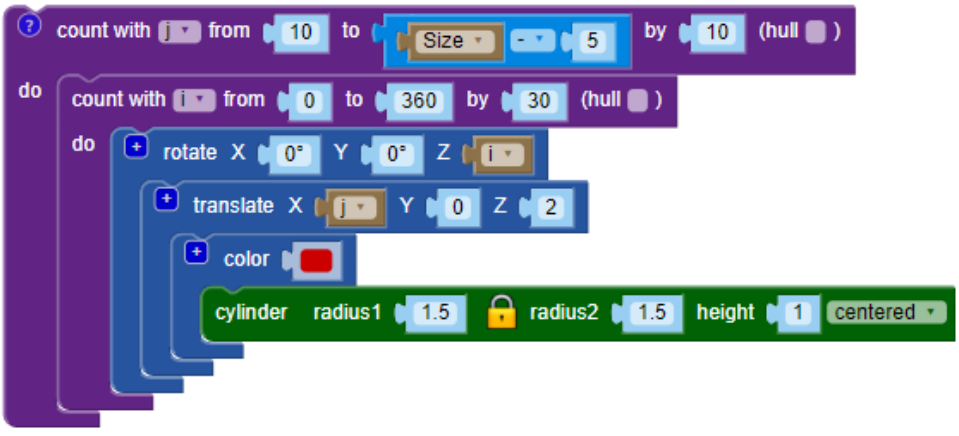
Customer 2 area = π ● r^2 = 3.14 ● 25^2 = 1962.5 cm^2

3) A customer loves crust and wants to order a pizza that has at least 80 cm of crust. What is the smallest whole number radius that will satisfy this desire?

80 cm = circumference = π ● d, so the diameter must be at least 80 cm/3.14 = 25.5 cm. Thus the radius needs to be at least 13 cm.

If some students finish early and you are not doing Part IV, have them come up with their own questions about circumference and area to ask one another.

Part IV is an optional section for students who are familiar with loops and would benefit from extra creative challenge. They are tasked with writing code that adds toppings to the pizza. The example code below shows how they might use iterated loops to add multiple rings of a specific topping depending on the size of the pizza. They can also change the parameters of the variable *i* to create pizzas that have different toppings on different halves.



Reflection Questions and Activities

1. What challenges would a pizza place face if they actually tried to automate a machine to make their pizzas rather than having humans do it?
2. If you like to have a high crust to rest of pizza ratio (ie. you want each pizza slice to be mostly crust), should you get a bigger pizza or a smaller pizza?
3. Other BlocksCAD activities in the area progression: Starry Night, Cardboard Recycling, Dice Nets, and Sous Chef
4. Other BlocksCAD activities in the modularity progression: Ice Cream Machine and Pythagoras on TV