Perimeter

v3.0

Applied Mathematics | Curriculum Packet

Overview:

In this lesson, students will learn how to determine the perimeters (inside and outside dimensions) of square, rectangular, and circular three-dimensional objects. Then, students will work in teams to build a custom structure and determine its perimeters.

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Learning Objectives & NGSS Alignment:

- Define perimeter.
- Determine the outer and inner perimeters of square, rectangular, and circular three-dimensional objects.
- Build a custom structure and then determine its perimeters.

Scientific/Engineering Practice - Using mathematics

Crosscutting Concept - Scale, proportion, and quantity

Activity Time:

120 Minutes

Targeted Grade Level:

3 - 5

Student Grouping:

Teams of 2

Additional Lesson Materials:

- Teacher Lesson Plan
- Student Engineering Workbook

Kid Spark STEM Lab:

STEM Pathways

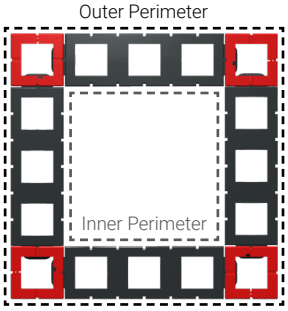
Note: *Two teams can share the engineering materials from one lab.*

Convergent Learning Activity:

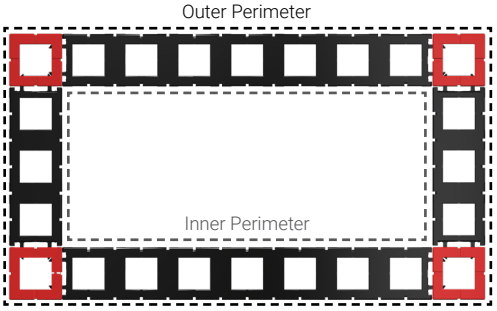
1. **What is Perimeter?**

   Perimeter is the distance or length around a shape or object. An object can have an outer perimeter as well as an inner perimeter. Perimeter can be measured in any type of unit such as centimeters or inches. For this lesson, we will be using metric units of measurement (centimeters) to determine the outer and inner perimeters of a square, rectangle, and circle.

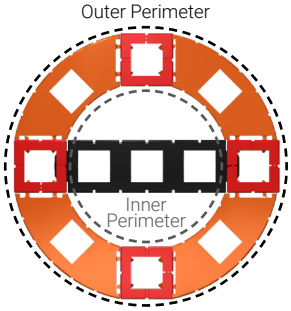
   Instructions: Assemble a square, rectangle, and circle as shown below.



4x Half Beams | 4x Blocks



2x Beams | 2x Half Beams | 4x Blocks



4x Mini Curved Beams | 1x Half Beam | 4x Blocks

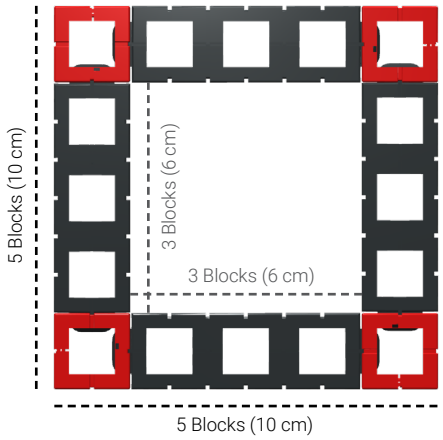
2. Determine the outer and inner perimeters of a square, rectangle, and circle.

Square

A square has four equal sides. To determine the outer or inner perimeter, count the number of blocks on one side and multiply by 4. This will determine the outer or inner perimeter in block units. Since each block represents 2 centimeters, multiply by 2 to determine the outer or inner perimeter in metric units.

Determine Outer Perimeter

The square is 5 blocks long on each outer side. Multiply 5 x 4 to get a total of 20 blocks. Since each block represents 2 centimeters, multiply 20 x 2 to get a **total outer perimeter of 40 centimeters**.



Determine Inner Perimeter

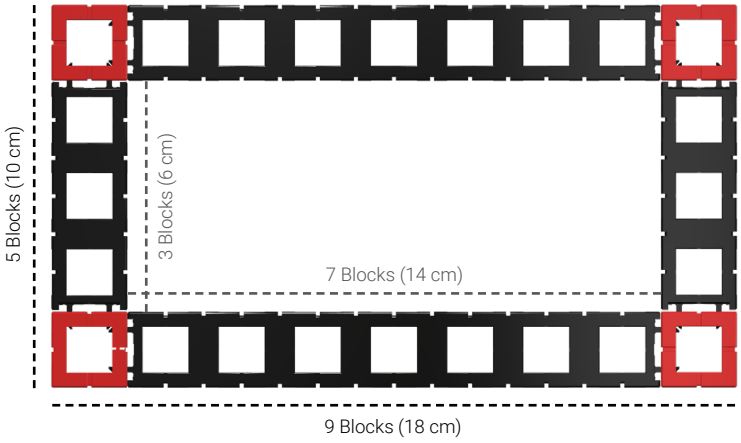
Instructions: Work with your team to determine the inner perimeter of the square.

Rectangle

To determine the outer or inner perimeter of a rectangle, add the length and depth, then multiply by 2. This will determine the outer or inner perimeter in block units. Since each block represents 2 centimeters, multiply by 2 to determine the outer or inner perimeter in metric units.

Determine Outer Perimeter

The rectangle has an outer length of 9 blocks and a depth of 5 blocks. Add 9 + 5 to get a total of 14. Multiply 14 x 2 to get a total of 28 blocks. Since each block represents 2 centimeters, multiply 28 x 2 to get a **total outer perimeter of 56 centimeters**.



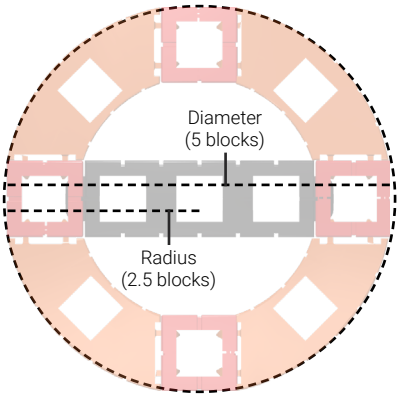
Determine Inner Perimeter

Instructions: Work with your team to determine the inner perimeter of the rectangle.

Circle

The perimeter of a circle is equal to its circumference (distance around the circle). For any circle, dividing its circumference by its diameter will give the exact same number of 3.141592... The greek letter **pi** (π) is used to represent this value. Pi is an irrational number, meaning it is a real number that cannot be expressed as a ratio of integers, i.e. as a fraction. Irrational numbers, when written as decimals do not terminate, nor do they repeat. To simplify calculations, pi is represented as π=3.14. To calculate the circumference or perimeter of a circle, the constant pi (π) is used in the following formula:

Circumference/Perimeter = π x d (d = diameter)

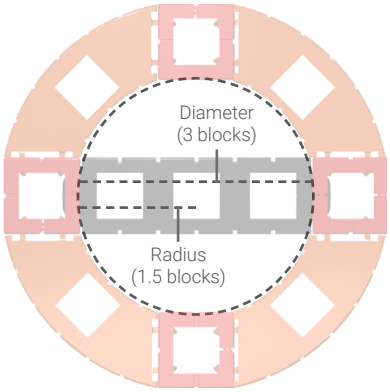


Determine Outer Perimeter

The outside of the circle has a diameter of 5 blocks (10 centimeters). Multiply 3.14 x 10 to get a **total outer perimeter of 31.4 centimeters.**

Determine Inner Perimeter

Instructions: Work with your team to determine the inner perimeter of the circle.



Divergent Learning Activity:

Scenario:

A local non-profit has recently received funds from the government to build several houses for families in need. The non-profit is currently trying to determine an efficient floor plan that they can use for all of the homes that will be built.

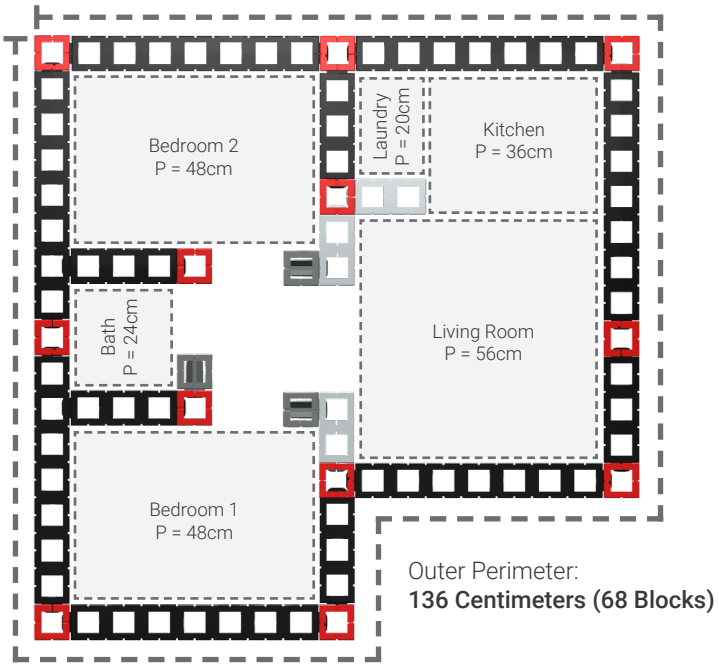
Design & Engineering Challenge:

Design and engineer a simple, single-layer floor plan for a house. (See example below).

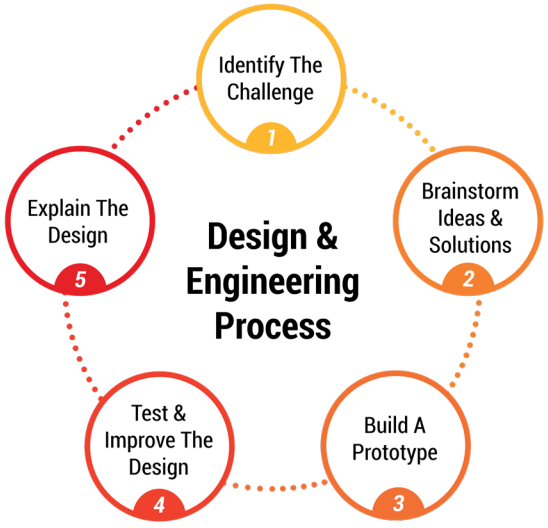
Specifications/Criteria:

1. Teams can work in teams of two to complete this challenge. Teams should record their progress in their Student Engineering Workbooks.
2. Teams must work through each step of the Design & Engineering Process to design, prototype, and refine a custom floor plan for a house. Teams will present their designs to the class when they are finished.
3. The floor plan should include 2 bedrooms, 1 bathroom, a living room, a laundry room, and a kitchen.
4. Teams must determine the outer perimeter of the floor plan, as well as the inner perimeters of each room inside the house.

Example Solution:



Outer Perimeter:
136 Centimeters (68 Blocks)



Challenge Evaluation

When teams have completed the Design & Engineering Challenge, it should be presented to the teacher and classmates for evaluation. Teams will be graded on the following criteria:

- **Specifications:** Does the design meet all specifications as stated in the design brief?
- **Team Collaboration:** How well did the team work together? Can each student describe how they contributed?
- **Design Quality/Aesthetics:** Is the design of high quality? Is it structurally strong, attractive, and well-proportioned?
- **Presentation:** How well did the team communicate all aspects of the design to others?

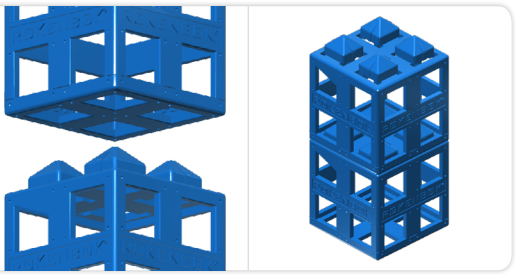
Grading Rubric	Advanced 5 Points	Proficient 4 Points	Partially Proficient 3 Points	Not Proficient 0 Points
Specifications	☐ Meets all specifications	☐ Meets most specifications	☐ Meets some specifications	☐ Does not meet specifications
Team Collaboration	☐ Every member of team contributed	☐ Most members of team contributed	☐ Some members of team contributed	☐ Team did not work together
Design Quality/ Aesthetics	☐ Great design/ aesthetics	☐ Good design/ aesthetics	☐ Average design/ aesthetics	☐ Poor design/ aesthetics
Presentation	☐ Great presentation/ well-explained	☐ Good presentation/ well-explained	☐ Poor presentation/ explanation	☐ No presentation/ explanation
Points	……	……	……	……
Total Points				…… /20

Building Basics

The following tips will be helpful when using Kid Spark engineering materials.

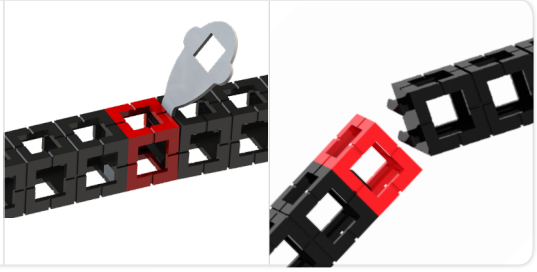
Connecting/Separating ROK Blocks:

ROK Blocks use a friction-fit, pyramid and opening system to connect. Simply press pyramids into openings to connect. To separate blocks, pull apart.



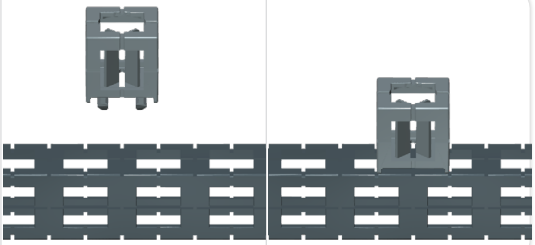
Connecting/Disconnect Smaller Engineering Materials:

Smaller engineering materials use a tab and opening system to connect. Angle one tab into the opening, and then snap into place. To disconnect, insert key into the engineered slot and twist.



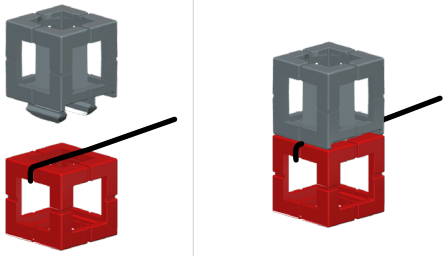
Snapping Across Openings:

Materials can be snapped directly into openings or across openings to provide structural support to a design. This will also allow certain designs to function correctly.



Attaching String:

In some instances, string may be needed in a design. Lay string across the opening and snap any component with tabs or pyramids into that opening. Be sure that the tabs are perpendicular to the string to create a tight fit.



Measuring:

The outside dimensions of a basic connector block are 2 cm on each edge. This means the length, depth, and height are each 2 cm. To determine the size of a project or build in centimeters, simply count the number of openings and multiply by two. Repeat this process for length, depth, and height.