LINES, POLYGONS, AND PLAY
COMPUTATIONAL THINKING + MATHEMATICS (GEOMETRY)
GRADES 3-4

UNIT SUMMARY

Lines, Polygons, and Play integrates Computational Thinking (CT) and mathematics, with a focus on **geometry and measurement**. Over the course of five lessons, students apply the computational thinking practice of **algorithmic design** to **draw** geometric shapes and **polygons** and **measure** their perimeters by **coding in Scratch**.

BEFORE YOU START

This unit uses the Scratch programming platform. To use Scratch with your students, you will need a **Scratch Teacher Account**. Instructions for setting up a Teacher Account can be found **here**. In our experience, Teacher Accounts can take a few days to become active, so we recommend creating your account ahead of time.

UNIT MATERIALS AND RESOURCES

- Internet-capable computers or tablets, either 1 per student or 1 per pair of students
- **CT + Mathematics Student Booklet**, 1 per student
- *Additional lesson-specific resources are linked within each lesson plan*

Want to create your own copy of this unit overview to use or share? Click here.

UNIT OVERVIEW

Lesson One	**Algorithmic Art** Students develop their understanding of what an algorithm is and how algorithms are used in different parts of their daily lives. They practice creating and decoding algorithms through dance and art. **Length:** 50 minutes **Resources:** Lesson Plan | Slide Deck

Lesson Two	**Scratch Basics** Students sign in to their Scratch accounts and get familiar with the different parts of the Scratch user interface. They explore how different blocks work by clicking on them and recording their observations. Using this knowledge, they use their imagination to create their own unique designs using the pen tool and motion blocks. *In an extension activity, students learn about Scratch's Backpack feature as a way to reuse sprites or scripts across projects, and use the Backpack as a way to save their Reset Script.* **Length:** 50 minutes **Resources:** Lesson Plan | Slide Deck | Extension: Scratch Backpacks
Lesson Three	**Polygon Challenge** Students learn how to code algorithms in Scratch (called scripts) by putting multiple blocks together. They work together to code scripts that draw different types of polygons. Students showcase their scripts with the class and reflect on how different scripts can produce the same shapes. **Length:** 50 minutes **Resources:** Lesson Plan | Slide Deck
Lesson Four	**Getting Loop-y** In this lesson, students are introduced to the concept of **abstraction** and apply that concept by using **loops** to simplify their scripts. They revisit the Algorithm Dance activity from Lesson One (with a twist!) and reflect on why loops are helpful tools when coding. **Length:** 50 minutes **Resources:** Lesson Plan | Slide Deck
Lesson Five	**Playing With Perimeter** In this lesson, students compare polygons to understand that we can measure the side lengths of shapes and add them up to find the shape's **perimeter**. Students are then introduced to the Scratch Pen Stamp Block, and use the Stamp Block to measure the perimeters of polygons in units of "Linuses." **Length:** 50 minutes **Resources:** Lesson Plan | Slide Deck

CONTENT AREA STANDARDS

2007 Academic Standards in Mathematics

GRADE 3 STANDARDS	LESSON				
Geometry and Measurement	**1**	**2**	**3**	**4**	**5**
3.3.1.1. *Identify parallel and perpendicular lines in various contexts, and use them to describe and create geometric shapes, such as right triangles, rectangles, parallelograms, and trapezoids.*		✔	✔	✔	✔
3.3.1.2. *Sketch polygons with a given number of sides or vertices (corners), such as pentagons, hexagons, and octagons*			✔	✔	✔
3.3.2.2. *Find the perimeter of a polygon by adding the lengths of the sides.*					✔
GRADE 4 STANDARDS	**LESSON**				
Geometry and Measurement	**1**	**2**	**3**	**4**	**5**
4.3.1.1. *Describe, classify, and sketch triangles, including equilateral, right, obtuse, and acute triangles. Recognize triangles in various contexts.*			✔	✔	✔
4.3.1.2. *Describe, classify, and draw quadrilaterals, including squares, rectangles, trapezoids, rhombuses, parallelograms, and kites. Recognize quadrilaterals in various contexts.*			✔	✔	✔
4.3.2.2. *Compare angles according to size. Classify angles as acute, right and obtuse.*		✔	✔	✔	✔
GRADE 5 STANDARDS	**LESSON**				
Note: Grade 5 Geometry and Measurement standards focus on three-dimensional, rather than two dimensional, shapes. Therefore, this curriculum doesn't align with the standards currently in place. However, it makes for an awesome review of describing and drawing different polygons.					

COMPUTATIONAL THINKING PRACTICES

PRACTICE	LESSON				
Data Collection and Analysis	**1**	**2**	**3**	**4**	**5**
Students will identify patterns in data.	✔	✔	✔	✔	✔
Students will use data to make predictions or explore cause-and-effect relationships.				✔	
Students will use input to change the outcome of a program.	✔	✔	✔	✔	✔
Abstraction and Modularization	**1**	**2**	**3**	**4**	**5**
Students will identify and analyze common features of coded algorithms	✔	✔	✔	✔	✔
Students will organize different parts of the code and explain the reasoning.			✔	✔	✔
Students will examine a problem to look for similarities, repetition, or conditional relationships.	✔	✔	✔	✔	✔
Algorithm Design	**1**	**2**	**3**	**4**	**5**
Students will use events and sequencing to decide on the order of steps in their code and what will begin their algorithm.	✔	✔	✔	✔	✔
Students will write an algorithm to explain part of a system.	✔		✔	✔	✔
Students will use loops to repeat parts of their programs.				✔	✔
Students will compare different algorithms for completing the same task and make an argument for which is best.			✔	✔	✔

Debugging	**1**	**2**	**3**	**4**	**5**
Students will revise a model or idea over time to show changes in understanding.	✔	✔	✔	✔	✔
Students will break down different parts of something created to determine how parts work and determine which parts are not working.	✔	✔	✔	✔	✔
Students will clearly articulate the problem to a friend.	✔		✔	✔	✔
Students will suggest changes to a classmate's model, plan, or idea.	✔		✔	✔	✔
Students will explain choices made during program development using code comments, presentations, and demonstrations.			✔	✔	✔

ATTRIBUTIONS

This unit was created by the Science Museum of Minnesota as part of the InspireCT project, with generous funding from the Cargill Foundation. We wish to also thank our teacher leaders in Minneapolis Public Schools and Hopkins Public Schools for their dedication and work to help bring these lessons to fruition. To connect, email inspirect@smm.org.