Geometry and Coding: Introducing an Interactive and Integrated Mathematics-Computer Science Unit

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GEOMETRY AND CODING: INTRODUCING AN INTERACTIVE AND INTEGRATED MATHEMATICS-COMPUTER SCIENCE SCIENCE UNIT

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1. Cache Code Math Project

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6. Discussion and Q&A
CACHE CODE MATH

CSFORALL GRANT
#2031382 &
#2031404

PIs: Mimi Recker, Jody Clarke-Midura,
Jessica Shumway, & Victor Lee
CODING IN ELEMENTARY SCHOOL
WHAT IS SCRATCH?

“Scratch is the world’s largest coding community for children and a coding language with a simple visual interface that allows young people to create digital stories, games, and animations.”

scratch.mit.edu/about

Let’s Explore!
1. Go to scratch.mit.edu
2. Click on “Start Creating”
Make a letter turn when you click it.

GET READY

Go to the Sprite Library.

Click the Letters category.

Choose a letter sprite.

ADD THIS CODE

when this sprite clicked

repeat 10

turn 18 degrees

Try different numbers.

TRY IT

Click your letter.

TIP

Click this block to reset the sprite's direction.

point in direction 90
EXPANSIVE FRAMING

Classify the quadrilateral in as many ways as possible. Write quadrilateral, trapezoid, parallelogram, rectangle, rhombus, or square.

5. quadrilateral, trapezoid

Algorithms and Programming (AP):

An algorithm is a sequence of steps designed to accomplish a specific task. Algorithms are translated into programs, or code, to provide instructions for computing devices. Algorithms and programming control all computing systems, empowering people to communicate with the world in new ways: efficiently, breaking analyzing data.

Standard 4.AP.2 - Create **programs** that include **events**, **loops**, and **conditionals**. *(Practice 5: Creating Computational Artifacts)*

Students will develop a set of instructions (a program) that include events, loops, and conditionals to facilitate and manage tasks. Event examples include mouse clicks, typing on the keyboard, and collisions between objects. Conditional statements are sets of commands that are tied to specific actions based on whether the condition evaluates to TRUE or FALSE. Other terms that can be used to specify the appropriate groups of instructions to execute under various conditions include AND, OR, and NOT.
Name each polygon. Then tell whether it is a regular polygon or not a regular polygon.

2. hexagon; regular polygon
3. quadrilateral; not a regular polygon
4. octagon; regular polygon

On Your Own
Name each polygon. Then tell whether it is a regular polygon or not a regular polygon.

5. quadrilateral; regular polygon
6. triangle; not a regular polygon
7. heptagon; regular polygon
8. hexagon; not a regular polygon

9. **Possible answer:** Both polygons are hexagons. All sides and angles are congruent in the hexagon shown in Exercise 2, so it is a regular polygon. The hexagon in Exercise 8 is not a regular polygon because the sides have different lengths and not all angles are congruent.
Algorithms and Programming (AP):

An algorithm is a sequence of steps designed to accomplish a specific task. Algorithms are translated into programs, or code, to provide instructions for computing devices. Algorithms and programming control all computing systems, empowering people to communicate with the world in new ways and solve compelling problems. The development process to create meaningful and efficient programs involves choosing which information to use and how to process and store it, breaking apart large problems into smaller ones, recombining existing solutions, and analyzing different solutions.

Standard 4.AP.2 - Create **programs** that include **events**, **loops**, and **conditionals**. *(Practice 5: Creating Computational Artifacts)*

Students will develop a set of instructions (a program) that include events, loops, and conditionals to facilitate and manage tasks. Event examples include mouse clicks, typing on the keyboard, and collisions between objects. Conditional statements are sets of commands that are tied to specific actions based on whether the condition evaluates to TRUE or FALSE. Other terms that can be used to specify the appropriate groups of instructions to execute under various conditions include AND, OR, and NOT.
<table>
<thead>
<tr>
<th>Lesson</th>
<th>Computer Lab</th>
<th>Mathematics Class</th>
<th>Notes</th>
<th>Suggested Timing/Pacing</th>
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<tbody>
<tr>
<td>#1 Math Routine</td>
<td>Math Routine: Which One Doesn’t Belong? (reasoning about shapes using attributes in Chapter 11 lessons)</td>
<td>Teach prior to Computer Lab lessons Supports a math content and language review Supports reasoning with attributes.</td>
<td>7-10 minutes Week of March 14, before or during Lesson 11.1</td>
<td></td>
</tr>
<tr>
<td>Computer Lab Scratch Card: Introduction to My Blocks</td>
<td>The typical Scratch Card (scratch card &amp; Jumping Game Cards) New jumping card (Jumping Maze)</td>
<td>Teach prior to the Computer Lab Quadrilateral activity Supports students’ learning of the My Blocks procedure in Scratch in order to focus on the mathematics in subsequent Computer Lab lessons</td>
<td>5-10 minutes Week of March 14 Exit Ticket</td>
<td></td>
</tr>
<tr>
<td>#2 Math Minilesson</td>
<td>Math MiniLesson: Visualizing the Shape – What Shape Will It Be? (extends Lesson 9.2 on order pairs and accesses background knowledge for Lessons 11.1-11.3)</td>
<td>Teach prior to Computer Lab Quadrilateral activity in Scratch to explain the use of coordinate grid and ordered pairs in Scratch Supports the use of ordered pairs in Scratch.</td>
<td>10-15 minutes Week of March 14</td>
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<tr>
<td>#3 Math Minilesson</td>
<td>Math MiniLesson: Conditional and Regular/Non-Regular Polygons (goes with Lesson 11.1 on polygons)</td>
<td>Teach prior to Computer Lab lesson Scratch Quadrilateral Quiz to explain the use of conditional statements with shapes Supports math content for Lesson 11.1 Supports use of conditionals in upcoming Computer Lab lessons</td>
<td>10 minutes Week of March 21, extends Lesson 11.1</td>
<td></td>
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<tr>
<td>Computer Lab Scratch Card: Scratch Quadrilaterals Quiz</td>
<td>Scratch Quadrilaterals Quiz card</td>
<td>Teach after #4 Math MiniLesson on conditionals and quadrilaterals</td>
<td>20-30 minutes Week of March 21 Exit Ticket</td>
<td></td>
</tr>
<tr>
<td>#4 Math Minilesson</td>
<td>Create a shapes quiz on polygons using conditionals and My Blocks</td>
<td>Supports the math content in Lesson 11.2 and introduces conditionals and procedures (My Blocks)</td>
<td>10 minutes Week of March 21, supports Lesson 11.3 Exit Ticket</td>
<td></td>
</tr>
<tr>
<td>Computer Lab Scratch Card: Triangle Quiz</td>
<td>Scratch Triangle Quiz card</td>
<td>Create a triangle quiz on equilateral, isosceles, and right triangle types using conditionals</td>
<td>Teach after students learn lesson 11.2 on triangles and after #2 Math Minilesson on conditionals Supports the math content in Lesson 11.2 and uses conditionals and procedures (My Blocks)</td>
<td>20-30 minutes Week of March 28 Exit Ticket</td>
</tr>
<tr>
<td>Computer Lab Scratch Card: Triangle Quiz</td>
<td>Scratch Triangle Quiz card</td>
<td>Create a triangle quiz on equilateral, isosceles, and right triangle types using conditionals</td>
<td>Teach after Computer Lab “Triangle Quiz” to explain the mathematics in my Q Card Math MiniLesson</td>
<td>10 minutes</td>
</tr>
</tbody>
</table>
1. What do the polygons in the left circle have in common with each other?
2. What do the polygons in the right circle have in common with each other?
3. What do the polygons in the center section have in common with both groups?
If a triangle is regular, then it has three congruent sides and angles, else it is not regular.

If a quadrilateral is regular, then it has four congruent angles and sides, else it is __________.

______ a pentagon has five congruent angles and sides, _____ it is a regular pentagon, _______ it is not regular.
If a quadrilateral is regular, 
then it has four _________________ angles and sides, 
else it is ___________.

Which quadrilaterals are regular quadrilaterals? How do you know?

Come up with a conditional statement to describe the regular quadrilateral you chose.
GEOMETRY
“SCRATCH CARDS”

shorturl.at/ayMOR

The sides of the square are all congruent. This means they are the same length.

Yes, you got it!

No, the correct option was 1: regular polygon because all sides are congruent and all angles are congruent.

After you connect the Quiz code, nano asks a question. Since a square is a regular polygon, the correct answer is 1.
EXPANSIVELY FRAMING MULTIPLICATION OF FRACTIONS AND CODE HS

Unpacking a Fraction Equation: Karel Shows the Product!

The Carter family has only $\frac{1}{2}$ of a box of cereal at the beginning of the week. They ate $\frac{3}{4}$ of the $\frac{1}{2}$ box of cereal.

- Shade the model to show $\frac{3}{4}$ of $\frac{1}{2}$ box of cereal.
- Write an expression to show $\frac{3}{4}$ of $\frac{1}{2}$ box of cereal. $\frac{1}{2} \times \frac{3}{4}$
- Will the product be equal to, greater than, or less than $\frac{1}{2}$? less than $\frac{3}{4}$?

The product will be less than either factor.

Why is the Product Getting Smaller?
$\frac{1}{3} \times \frac{4}{5} = \frac{4}{15}$
LEARNING EXPONENTS AND SCRATCH CODING

The Scratch coding example demonstrates how to calculate exponentiation using loops. The code sets variables `first_number` and `second_number` to 4 and 3, respectively. It then calculates the product of these numbers using a loop, which is visually represented on the Stage by the movement of sprites.
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Q&A

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