

US Common Core Standards

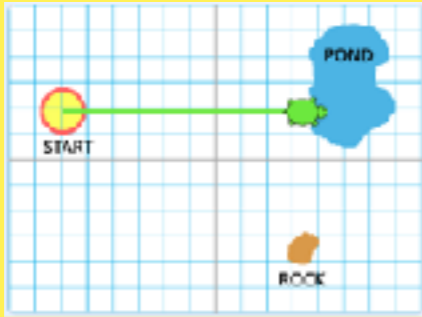
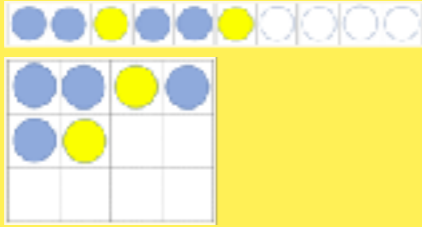
UNDERSTANDING MATH THROUGH CODING

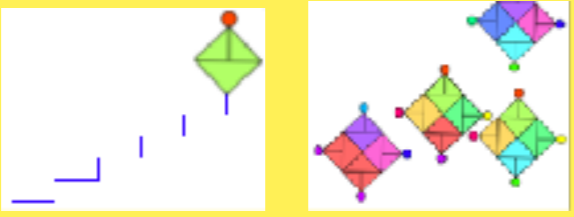
CLASSROOM-TESTED, RESEARCH-BASED LESSONS

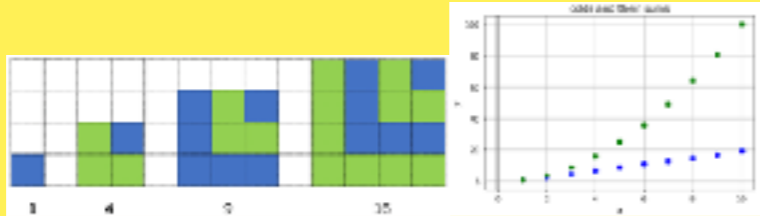
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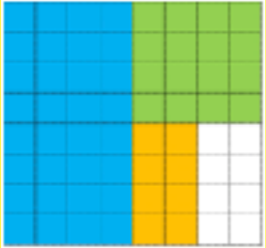


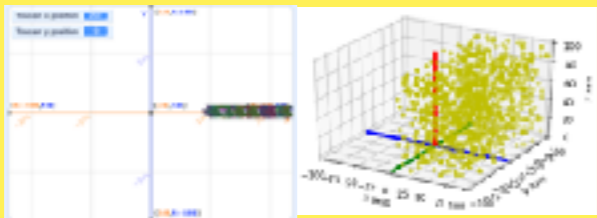
From the research of GEORGE GADANIDIS, PhD — Western University


PAGE	MODULES & LESSONS	CONTENT CORRELATION
5	TURTLE WALKS 	In this Module, students use and edit simple Scratch code to move Turtle to the pond and to the rock.
6	1. Turtle walks to the pond with Scratch	Gr.1: measure lengths indirectly and by iterating length units Gr.2: relate addition and subtraction to length
9	2. Turtle turns and walks with Scratch	Gr.1: measure lengths indirectly and by iterating length units Gr.2: relate addition and subtraction to length; reason with shapes and their attributes
12	REPEATING PATTERNS 	In this Module, students stamp repeating patterns on inch-grid chart paper. Students sing, dance and perform the patterns on xylophones. They use and edit code to create such patterns. For repeating patterns on a grid, they identify fractions as areas.
13	1. Repeating patterns	K: look for and express regularity in repeated reasoning Gr.1: look for and express regularity in repeated reasoning Gr.2: look for and express regularity in repeated reasoning Gr.3: look for and express regularity in repeated reasoning
16	2. Repeating patterns with sequential Scratch code	Gr.1: look for and express regularity in repeated reasoning Gr.2: look for and express regularity in repeated reasoning Gr.3: look for and express regularity in repeated reasoning
19	3. Repeating patterns with repeating Scratch code	Gr.1: look for and express regularity in repeated reasoning Gr.2: look for and express regularity in repeated reasoning Gr.3: look for and express regularity in repeated reasoning
22	4. Repeating patterns on a Grid	Gr.1: look for and express regularity in repeated reasoning Gr.2: look for and express regularity in repeated reasoning Gr.3: look for and express regularity in repeated reasoning
25	5. Repeating patterns on a grid with code	Gr.1: look for and express regularity in repeated reasoning Gr.2: look for and express regularity in repeated reasoning Gr.3: look for and express regularity in repeated reasoning

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28	MOVEMENT PATTERNS 	<p>In this Module, students use and edit simple Scratch code to move a sprite on the Scratch Stage using repeating movement patterns. The sprite leaves a trail of the movement patterns. They use and edit simple Scratch code to turn and stamp a sprite, and change its colour pattern.</p>
29	1. Sequential walk patterns with Scratch	<p>Gr.1: look for and express regularity in repeated reasoning Gr.2: look for and express regularity in repeated reasoning; relate addition and subtraction to length; reason with shapes and their attributes Gr.3: look for and express regularity in repeated reasoning</p>
32	2. Concurrent walk patterns with Scratch	<p>Gr.1: look for and express regularity in repeated reasoning Gr.2: look for and express regularity in repeated reasoning; relate addition and subtraction to length; reason with shapes and their attributes Gr.3: look for and express regularity in repeated reasoning</p>
35	3. Walk patterns with Scratch repeat blocks	<p>Gr.1: look for and express regularity in repeated reasoning Gr.2: look for and express regularity in repeated reasoning; relate addition and subtraction to length; reason with shapes and their attributes Gr.3: look for and express regularity in repeated reasoning</p>
38	4. Turn and stamp patterns with Scratch	<p>Gr.2: look for and express regularity in repeated reasoning; relate addition and subtraction to length; reason with shapes and their attributes Gr.3: look for and express regularity in repeated reasoning</p>

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41	ODD & EVEN NUMBER PATTERNS 	<p>In this Module, students see that odd numbers “hide” in squares. They use visual and numeric patterns to understand odd, even and natural numbers and their sums. They plot odd numbers and their sums on a bar graph and notice their growth rates. They use and edit Python code to list numbers and their sums and identify patterns and relationships. They use and edit Scratch and Python code to plot graphs of numbers and their sums.</p>
42	1. Number patterns: odds & evens	<p>Gr.1: work with addition and subtraction equations; add and subtract within 20; determine the unknown whole number in an addition or subtraction equation relating three whole numbers; represent and solve problems involving addition and subtraction</p> <p>Gr.3: identify and explain patterns in arithmetic</p> <p>Gr.4: use the four operations with whole numbers to solve problems; generate and analyze patterns</p>
45	2. Sum patterns: odds & evens	<p>Gr.1: work with addition and subtraction equations; add and subtract within 20; determine the unknown whole number in an addition or subtraction equation relating three whole numbers; represent and solve problems involving addition and subtraction</p>
48	3. Algebraic expressions: odds, even and naturals	<p>Gr.5: generate two numerical patterns using two given rules; identify apparent relationships between corresponding terms</p> <p>Gr.6: apply and extend previous understandings of arithmetic to algebraic expressions.</p> <p>Gr.7: solve real-life and mathematical problems using numerical and algebraic expressions and equations.</p>
51	4. Sum patterns: odds & evens with Python	<p>Gr.5: generate two numerical patterns using two given rules; identify apparent relationships between corresponding terms</p> <p>Gr.6: apply and extend previous understandings of arithmetic to algebraic expressions.</p> <p>Gr.7: solve real-life and mathematical problems using numerical and algebraic expressions and equations.</p>
54	5. Algebraic expressions: sums of numbers	<p>Gr.5: generate two numerical patterns using two given rules; identify apparent relationships between corresponding terms</p> <p>Gr.6: apply and extend previous understandings of arithmetic to algebraic expressions.</p> <p>Gr.7: solve real-life and mathematical problems using numerical and algebraic expressions and equations.</p>
57	6. Plotting numbers & their sums with bar graphs	<p>Gr.5: generate two numerical patterns using two given rules; identify apparent relationships between corresponding terms</p> <p>Gr.6: apply and extend previous understandings of arithmetic to algebraic expressions.</p> <p>Gr.7: solve real-life and mathematical problems using numerical and algebraic expressions and equations.</p>
60	7. Plotting numbers & their sums with Scratch	<p>Gr.6: apply and extend previous understandings of arithmetic to algebraic expressions.</p> <p>Gr.7: solve real-life and mathematical problems using numerical and algebraic expressions and equations.</p>
63	8. Plotting numbers & their sums with Python	<p>Gr.6: apply and extend previous understandings of arithmetic to algebraic expressions.</p> <p>Gr.7: solve real-life and mathematical problems using numerical and algebraic expressions and equations.</p>

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66	INFINITY + FRACTIONS  	<p>In this Module, students see that when walking to the classroom door, they have to travel an infinite number of fractions ($1/2$, $1/4$, $1/8$, $1/16$ and so forth). They represent these fractions as area diagrams and realize that an infinite number of fractions can fit in a single square.</p>
67	1. Walk to the door	<p>Gr.3: develop understanding of fractions; understand a fraction $1/b$ as the quantity formed by 1 part when a whole is partitioned into b equal parts;</p> <p>Gr.4: extend understanding of fraction equivalence and ordering</p>
70	2. Bug walks to strawberry with Scratch	<p>Gr.3: develop understanding of fractions; understand a fraction $1/b$ as the quantity formed by 1 part when a whole is partitioned into b equal parts;</p> <p>Gr.4: extend understanding of fraction equivalence and ordering</p>
73	3. Infinity + fractions = math art	<p>Gr.3: develop understanding of fractions; understand a fraction $1/b$ as the quantity formed by 1 part when a whole is partitioned into b equal parts;</p> <p>Gr.4: extend understanding of fraction equivalence and ordering</p>
76	Fractions + decimals + infinity + Python	<p>Gr.3: develop understanding of fractions; understand a fraction $1/b$ as the quantity formed by 1 part when a whole is partitioned into b equal parts;</p> <p>Gr.4: extend understanding of fraction equivalence and ordering</p>

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79	INEQUALITIES WITH SCRATCH 	<p>In this Module, students plot inequalities like $x > 10$ on line graphs. They use and edit Scratch code to plot inequalities in one and two dimensions. They use their classroom space to visualize inequalities plotted in three dimensions.</p>
80	Inequalities like $x > 100$	<p>Gr.5: graph points on the coordinate plane to solve real-world and mathematical problems Gr.6: reason about & solve one-variable equations & inequalities; represent & analyze quantitative relationships between dependent & independent variables Gr.8: define, evaluate, and compare functions; Use functions to model relationships between quantities</p>
83	Inequalities like $x + 50 > 100$	<p>Gr.5: graph points on the coordinate plane to solve real-world and mathematical problems Gr.6: reason about & solve one-variable equations & inequalities; represent & analyze quantitative relationships between dependent & independent variables Gr.8: define, evaluate, and compare functions; Use functions to model relationships between quantities</p>
86	Inequalities like $2x + 40 > 100$	<p>Gr.5: graph points on the coordinate plane to solve real-world and mathematical problems Gr.6: reason about & solve one-variable equations & inequalities; represent & analyze quantitative relationships between dependent & independent variables Gr.8: define, evaluate, and compare functions; Use functions to model relationships between quantities</p>
89	Inequalities in 2 and 3 dimensions	<p>Gr.5: graph points on the coordinate plane to solve real-world and mathematical problems Gr.6: reason about & solve one-variable equations & inequalities; represent & analyze quantitative relationships between dependent & independent variables Gr.8: define, evaluate, and compare functions; Use functions to model relationships between quantities</p>

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92	MAKING 10 	<p>In this Module, students make sums of 10. They represent the sums using linking blocks of two colours. They use Scratch to create stamping patterns that represent sums of 10. Students use the number sentence $_ + _ = 10$. They roll a number cube to get the first number and calculate the second number. They plot each pair of numbers on a grid and are surprised that they line up. They use and edit Scratch code to plot $_ + _ = 10$, as well as $_ + _ < 10$.</p>
93	1. Making 10	<p>K: decompose numbers less than or equal to 10 into pairs in more than one way; For any number from 1 to 9, find the number that makes 10 when added to the given number</p> <p>Gr.1: work with addition and subtraction equations; add and subtract within 20; determine the unknown whole number in an addition or subtraction equation relating three whole numbers; represent and solve problems involving addition and subtraction</p>
96	2. Making 8	<p>K: decompose numbers less than or equal to 10 into pairs in more than one way; For any number from 1 to 9, find the number that makes 10 when added to the given number</p> <p>Gr.1: work with addition and subtraction equations; add and subtract within 20; determine the unknown whole number in an addition or subtraction equation relating three whole numbers; represent and solve problems involving addition and subtraction</p>
99	3. Making 8 with sequential Scratch code	<p>K: decompose numbers less than or equal to 10 into pairs in more than one way; For any number from 1 to 9, find the number that makes 10 when added to the given number</p> <p>Gr.1: work with addition and subtraction equations; add and subtract within 20; determine the unknown whole number in an addition or subtraction equation relating three whole numbers; represent and solve problems involving addition and subtraction</p>
102	4. Making less than 8	<p>Gr.1: work with addition and subtraction equations; add and subtract within 20; determine the unknown whole number in an addition or subtraction equation relating three whole numbers; represent and solve problems involving addition and subtraction.</p> <p>Gr.6: reason about & solve one-variable equations & inequalities; represent & analyze quantitative relationships between dependent & independent variables</p>
105	5. Plotting $_ + _ = 10$ on a grid	<p>Gr.5: graph points on the coordinate plane to solve real-world and mathematical problems</p> <p>Gr.6: reason about & solve one-variable equations & inequalities; represent & analyze quantitative relationships between dependent & independent variables</p> <p>Gr.8: define, evaluate, and compare functions; Use functions to model relationships between quantities</p>
108	6. Making 10 simulation & game	<p>Gr.5: graph points on the coordinate plane to solve real-world and mathematical problems</p> <p>Gr.6: reason about & solve one-variable equations & inequalities; represent & analyze quantitative relationships between dependent & independent variables</p> <p>Gr.8: define, evaluate, and compare functions; Use functions to model relationships between quantities</p>
111	7. Plotting $_ + _ = 100$ with Scratch	<p>Gr.5: graph points on the coordinate plane to solve real-world and mathematical problems</p> <p>Gr.6: reason about & solve one-variable equations & inequalities; represent & analyze quantitative relationships between dependent & independent variables</p> <p>Gr.8: define, evaluate, and compare functions; Use functions to model relationships between quantities</p>
114	8. Plotting $_ + _ < 100$ on a Grid	<p>Gr.5: graph points on the coordinate plane to solve real-world and mathematical problems</p> <p>Gr.6: reason about & solve one-variable equations & inequalities; represent & analyze quantitative relationships between dependent & independent variables</p> <p>Gr.8: define, evaluate, and compare functions; Use functions to model relationships between quantities</p>
117	9. Plotting $_ + _ < 100$ with Scratch	<p>Gr.5: graph points on the coordinate plane to solve real-world and mathematical problems</p> <p>Gr.6: reason about & solve one-variable equations & inequalities; represent & analyze quantitative relationships between dependent & independent variables</p> <p>Gr.8: define, evaluate, and compare functions; Use functions to model relationships between quantities</p>
120	10. Fixing a plotting issue with Scratch	<p>Gr.5: graph points on the coordinate plane to solve real-world and mathematical problems</p> <p>Gr.6: reason about & solve one-variable equations & inequalities; represent & analyze quantitative relationships between dependent & independent variables</p> <p>Gr.8: define, evaluate, and compare functions; Use functions to model relationships between quantities</p>