## Fun with Fractals Classes

Any class can be scheduled as a one-time experience, or a combination of classes can be scheduled across the year as a seasonal mini-course, reinforcing the concept of fractal patterns—and tripling the fun!

Classroom teachers are invited to participate and expected to assist during these hands-on classes.

<table>
<thead>
<tr>
<th>Class</th>
<th>Description</th>
<th>Price</th>
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</table>
| **Sierpinski Triangles: An Introduction to Fractal Patterns** | Students will learn about “messy shapes”—heads of broccoli, trees, mountain ranges—and how they all share the same fractal pattern. During this class, students will listen to *Mysterious Patterns: Finding Fractals in Nature*, explore the fundamental principle of fractals, and create beautiful Sierpinski triangles. Each student will need: sharp pencil, eraser, ruler, scissors, and set of markers — the more colors, the better! | **In-Person:**  
$100 / class (maximum of 30 students)  
$20.00 additional materials fee  
62.5¢ per mile (60 mile maximum)  
**Virtual:**  
$100 / class  
$35.00 additional materials & postage fee |
| **Koch Curve Snowflakes: A Wintertime Fractal Pattern** | During this class, students will learn about the Koch curve—a fractal pattern—first described by Swedish mathematician Helge von Koch and will use that pattern to transform equilateral triangles into beautiful, glistening Koch curve snowflakes. Fun (and interesting) fact: A Koch curve snowflake has an infinite perimeter but a finite area! Each student will need: sharp pencil, eraser, ruler, scissors. | **In-Person:**  
$100 / class (maximum of 30 students)  
$30.00 additional materials fee  
62.5¢ per mile (60 mile maximum)  
**Virtual:**  
$100 / class  
$45.00 additional materials & postage fee |
| **Fractal Flowers: A Springtime Fractal Pattern** | During this class, students will use a repeating pattern of different-sized circles to create a beautiful fractal flower. Each student will need: sharp pencil, eraser, and set of colored pencils — the more colors, the better! | **In-Person:**  
$100 / class (maximum of 30 students)  
$30.00 additional materials fee  
62.5¢ per mile (60 mile maximum)  
**Virtual:**  
$100 / class  
$45.00 additional materials & postage fee |
# Fun with Fractals Classes:
*Alignment to NCTM Mathematical Practices, Content Standards, and Process Standards*

<table>
<thead>
<tr>
<th>Mathematical Practices (NCTM, 2014)</th>
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<tbody>
<tr>
<td>1. Make sense of problems and persevere in solving them.</td>
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<td>2. Reason abstractly and quantitatively.</td>
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<td>3. Construct viable arguments and critique the reasoning of others.</td>
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<td>4. Model with mathematics.</td>
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<td>5. Use appropriate tools strategically.</td>
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<td>6. Attend to precision.</td>
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<td>7. Look for and make use of structure.</td>
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<td>8. Look for and express regularity in repeated reasoning.</td>
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## Prekindergarten—Grade 12 Content Standards (NCTM, 2000)
*Instructional programs from prekindergarten through grade 12 should enable all students to—*

| Number & Operations | • understand numbers, ways of representing numbers, relationships among numbers, and number systems;  
|                     | • understand meanings of operations and how they relate to one another;  
|                     | • compute fluently and make reasonable estimates.  |
| Algebra             | • understand patterns, relations, and functions;  
|                     | • represent and analyze mathematical situations and structures using algebraic symbols;  
|                     | • use mathematical models to represent and understand quantitative relationships;  
|                     | • analyze change in various contexts.  |
| Geometry | • analyze characteristics and properties of two- and three-dimensional geometric shapes and develop mathematical arguments about geometric relationships;  
• specify locations and describe spatial relationships using coordinate geometry and other representational descriptions;  
• apply transformations and use symmetry to analyze mathematical situations;  
• use visualization, spatial reasoning, and geometric modeling to solve problems. |
| Measurement | • understand measurable attributes of objects and the units, systems, and processes of measurement;  
• apply appropriate techniques, tools, and formulas to determine measurements. |
| Data Analysis & Probability | • formulate questions that can be addressed with data and collect, organize, and display relevant data to analyze them;  
• select and use appropriate statistical methods to analyze data;  
• develop and evaluate inferences and predictions that are based on data;  
• understand and apply basic concepts of probability. |
| Prekindergarten—Grade 12 Process Standards (NCTM, 2000) | Instructional programs from prekindergarten through grade 12 should enable all students to—  
• build new mathematical knowledge through problem solving;  
• solve problems that arise in mathematics and in other contexts;  
• apply and adapt a variety of appropriate strategies to solve problems;  
• monitor and reflect on the process of mathematical problem solving. |
| Reasoning & Proof | • recognize reasoning and proof as fundamental aspects of mathematics;  
|                  | • make and investigate mathematical conjectures;               
|                  | • develop and evaluate mathematical arguments and proofs;       
|                  | • select and use various types of reasoning and methods of proof. |
| Communication    | • organize and consolidate their mathematical thinking through communication;  
|                  | • communicate their mathematical thinking coherently and clearly to peers, teachers, and others;  
|                  | • analyze and evaluate the mathematical thinking and strategies of others;  
|                  | • use the language of mathematics to express mathematical ideas precisely. |
| Connections      | • recognize and use connections among mathematical ideas;       
|                  | • understand how mathematical ideas interconnect and build on one another to produce a coherent whole;  
|                  | • recognize and apply mathematics in contexts outside of mathematics. |
| Representation   | • create and use representations to organize, record, and communicate mathematical ideas;  
|                  | • select, apply, and translate among mathematical representations to solve problems;  
|                  | • use representations to model and interpret physical, social, and mathematical phenomena. |
