Dear Family,

The next Unit in your child's mathematics class this year is **Butterflies, Pinwheels, and Wallpaper: Symmetry and Transformations.** Students will develop their understanding of congruence and similarity of geometric figures. This Unit is an introduction to the topic in mathematics called *transformational geometry*.

Unit Goals

Students often have an intuitive understanding of symmetry. They recognize that a design is symmetric if some part of it is repeated in a regular pattern. Though students begin recognizing symmetric figures at an early age, the analytical understanding needed to confirm symmetry and to construct figures with given symmetries requires greater mathematical sophistication. *Butterflies, Pinwheels, and Wallpaper*, the final geometry and measurement Unit in the *Connected Mathematics* curriculum, helps students to refine their knowledge of symmetry and to use it to make mathematical arguments.

Symmetry is commonly described in terms of transformations. Symmetry transformations, or rigid motions, include reflections, rotations, and translations. These transformations preserve both angle measures and side lengths, resulting in an image that is congruent to the original figure. In contrast, similarity transformations, such as dilations, change the size of a figure while preserving its shape. Students learned about similar figures in the Grade 7 Unit *Stretching and Shrinking.* This Unit strengthens students' awareness of symmetry, congruence, similarity, their connections, and begins to develop their understanding of the underlying mathematics.

Homework and Conversations About the Mathematics

You can help your child with homework by asking questions such as the following:

- How does symmetry help in describing the shape and properties of a figure or design?
- What figures in a pattern are congruent? What parts of the congruent figures match when you transform one onto the other?
- What figures in a problem are similar?

You can help your child with his or her work for this Unit in several ways:
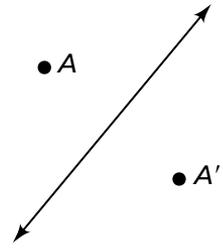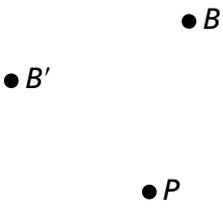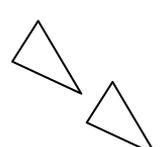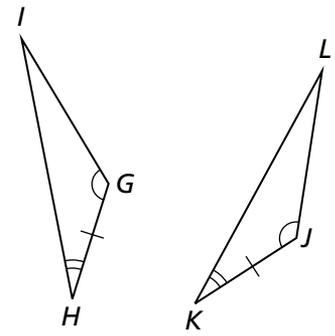
- Talk with your child about the ideas presented in the text about symmetry. Look with your child for examples of each type of symmetry.
- Talk with your child about careers that use the knowledge of geometry, such as crystallography, a science that deals with the forms and structures of crystals.
- Look over your child's homework and make sure that all the questions are answered and that the explanations are clear.

Common Core State Standards

Students develop and use all of the Standards for Mathematical Practice throughout the curriculum. In this Unit, students spend a significant amount of time using appropriate tools strategically, such as rulers, protractors, and tracing paper. *Butterflies, Pinwheels, and Wallpaper* focuses largely on the Geometry domain by asking students to explore congruence and similarity as they use physical models or geometry software.

A few important mathematical ideas that your child will learn in *Butterflies, Pinwheels, and Wallpaper* are given on the next page. As always, if you have any questions or concerns about this Unit or about your child's progress in the class, please feel free to call.

Sincerely,

Important Concepts	Examples
Symmetry Transformations You can use symmetry transformations—reflections, rotations, and translations—to create symmetric designs and to compare the size and shape of figures. You can specify a **reflection** by giving the line of reflection.	Point *A* and its reflection image point *A'* lie on a line that is perpendicular to the line of symmetry and are equidistant from that line.
You can specify a **rotation** by giving the center of rotation and the angle of the turn. You can specify a **translation** by giving the length and direction of the slide. Usually, an arrow with the appropriate length and direction is drawn.	Point *B* and its image point *B'* are equidistant from the center of rotation *P*. A point under a rotation "travels" on the arc of a circle whose radius is the constant distance between point *B* and center *P*. The set of circles on which the points of a figure "travel" are concentric circles with center *P*. The angles formed by the vertex points of the figure and their rotation images all have measures equal to the angle of the turn. If you draw the segments connecting a number of points to their images, the segments will be parallel and the same length. The length is equal to the distance of the translation.
Congruent Figures Figures of the same size and shape are congruent.	You can "move" one triangle exactly onto the other by a sequence of symmetry transformations.
Similarity A two-dimensional figure is similar to another if the second can be obtained from the first by a sequence of rotations, reflections, translations, and dilations. A **dilation** enlarges or reduces a figure by scale factor about a center point so that the original figure and its image are similar. You can specify a dilation by giving the center of dilation and the scale factor.	Dilations conserve the shape of a figure, but not the size. A scale factor that is greater than 1 stretches the figure. A scale factor that is less than 1 shrinks the figure.