Dear Family,

The first Unit in your child's mathematics class this year is ***Shapes and Designs: Two-Dimensional Geometry.*** Students will recognize, analyze, measure, and reason about the shapes and visual patterns that are important features of our world. Students analyze the properties that make certain shapes special and useful.

Unit Goals

The goal of *Shapes and Designs* is to have students discover and analyze many of the key properties of polygonal shapes that make them useful and attractive.

This Unit focuses on polygons and develops two basic sub-themes:

- *How do the measures of angles in a polygon determine its possible shapes and uses?*
- *How do the lengths of edges in a polygon determine its possible shapes and uses?*

While some attention is given to naming familiar figures, each Investigation focuses on particular key properties of figures and the importance of those properties in applications. For example, students are asked to examine what properties of triangles make them useful in construction and design, and why triangles are preferred over quadrilaterals. Students also examine and evaluate angle properties of polygons that make some able to tile a surface whereas others cannot. We frequently ask students to find and describe places where they see polygons of particular types and to puzzle over why those particular shapes are used.

Homework and Having Conversations About The Mathematics

You can help your child with homework and encourage sound mathematical habits during this Unit by asking questions such as:

- What kinds of shapes/polygons will cover a flat surface?
- What do these shapes have in common?
- How do simple polygons work together to make more complex shapes?
- How can angle measures be estimated?
- How can angles be measured with more accuracy?

You can help your child with his or her work for this Unit in several ways:

- Point out different shapes you see, and ask your child to find other shapes.
- Whenever you notice an interesting shape in a newspaper or a magazine, discuss with your child whether it is one of the polygons mentioned in the Unit, and suggest that it might be cut out and saved for the *Shapes and Designs* Unit Project.

In your child's notebook, you can find worked-out examples, notes on the mathematics of the Unit, and descriptions of the vocabulary words.

Common Core State Standards

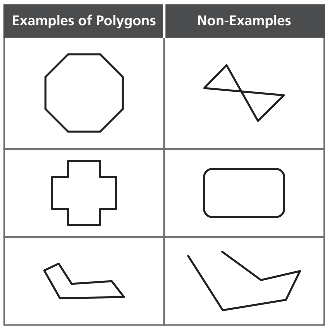
While all of the Standards of Mathematical Practice are developed and used by students throughout the curriculum, particular attention is paid to constructing viable arguments and critiquing the reasoning of others as students make conjectures about the construction of geometric shapes (angles and side lengths) and justify their responses to others. *Shapes and Designs* focuses largely on the Geometry domain.

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

Sincerely,

Important Concepts	Examples

Polygon
A shape formed by line segments so that each of the segments meets exactly two other segments, and all of the points where the segments meet are end points of the segments.



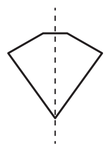
Polygon Names

Triangle: 3 sides and 3 angles
Quadrilateral: 4 sides and 4 angles
Pentagon: 5 sides and 5 angles
Hexagon: 6 sides and 6 angles
Heptagon: 7 sides and 7 angles
Octagon: 8 sides and 8 angles
Nonagon: 9 sides and 9 angles
Decagon: 10 sides and 10 angles
Dodecagon: 12 sides and 12 angles

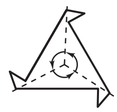
Regular polygon: Polygons whose side lengths are equal and interior angle measures are equal.

Irregular polygon: A polygon which either has two sides with different lengths or two angles with different measures.

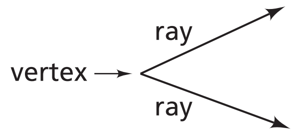
Line (or mirror) Symmetry
If the polygon is folded over the line of symmetry, the two halves of the shape will match exactly.



Rotational (or turn) Symmetry
A polygon with turn symmetry can be turned around its center point less than a full turn and still look the same at certain angles of rotation.

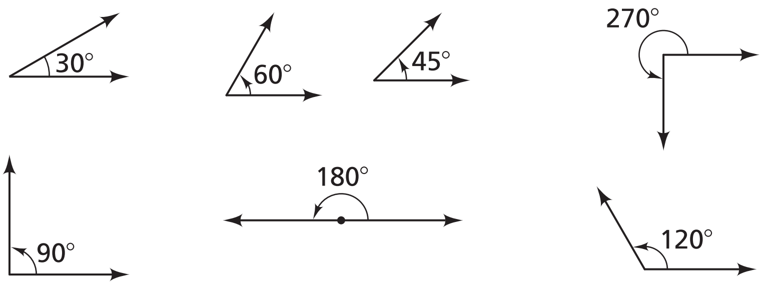


Angles
Angles are figures formed by two rays or line segments that have a common vertex. The **vertex** of an angle is the point where the two rays meet or intersect. Angles are measured in degrees.

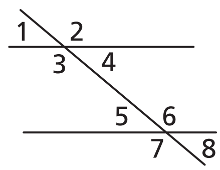


Angle Measures
Work is done to relate angles to right angles, to develop students' estimation skills. Combinations and partitions of 90° are used. 30°, 45°, 60°, 90°, 120°, 180°, 270°, and 360° are used as benchmarks to estimate angle size.

The need for more precision requires techniques for measuring angles. Students use an **angle ruler** or **protractor** to measure angles.



Angles and Parallel Lines
Students explore the angles created when two parallel lines are cut by a line. The line that cuts (intersects) the parallel lines is called a **transversal**. Angles 1 and 5, angles 2 and 6, angles 3 and 7, and angles 4 and 8 are called **corresponding angles**. Angles 4 and 5 and angles 3 and 6 are called **alternate interior angles**. Parallel lines cut by a transversal create equal corresponding angles and equal alternate interior angles.



Parallel lines and transversals help explain some special features of parallelograms such as the opposite angles have equal measures or that the sum of the measures of two adjacent angles is 180°.

Polygons that Tile a Plane
For regular polygons to tile a plane, the angle measure of an interior angle must be a factor of 360°.

Only three regular polygons can tile a plane: an equilateral triangle (60° angles), a square (90° angles) and a regular hexagon (120° angles). There are also combinations of regular polygons that will tile, such as 2 octagons and a square.

Triangle Inequality Theorem
The sum of two side lengths of a triangle must be greater than the 3rd side length.

If the side lengths are a, b, and c, then the sum of any two sides is greater than the third: $a + b > c$, $b + c > a$, $c + a > b$