



# "Shapes & Designs" Math Newsletter

Dear Family,

The next unit in your child's mathematics class this year is **Shapes and Designs: Two-Dimensional Geometry**. It is the first unit in the Connected Mathematics geometry strand. Students will recognize, analyze, measure, and reason about the shapes and visual patterns that are important features of our world. It builds on students' previous exposure to simple shapes by analyzing 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 these two themes:

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

Each investigation focuses on some key properties of figures and the importance of those properties in applications. Students are periodically asked to identify differences among particular classifications of polygons. Students are also asked to find and describe places where they see different polygons and to think about why those shapes are used.

### HELPING WITH HOMEWORK

You can help with homework and encourage sound mathematical habits as your child studies 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 can angle measures be estimated?
- How can angles be measured with more accuracy?

In your child's notebook, you can find worked-out examples from problems done in class, notes on the unit's mathematics, and descriptions of the vocabulary words.

### HAVING CONVERSATIONS ABOUT THE MATHEMATICS IN SHAPES AND DESIGNS

You can help your child see how this aspect of geometry is important in everyday life in several ways:

- 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 project.
- Have your child share his or her mathematics notebook with you, showing you what has been recorded about the different shapes being studied. Ask your child to explain why these ideas are important, and try to share ways that shapes help you with work or hobbies.
- Look over your child's homework and make sure all questions are answered and that explanations are clear. A few important mathematical ideas that your child will learn in Shapes and Designs are given on the back. As always, if you have any questions or concerns about this unit or your child's progress in class, please feel free to call.

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## Descriptive Glossary,

**acute angle** - An angle whose measure is less than  $90^\circ$ .

**angle** - The figure formed by two rays or line segments that have a common vertex.

**angle sum** - The sum of all the measures of the interior angles of a polygon.

**central angle** - An angle with a vertex at the center of a circle and whose sides are radii of the circle.

**degree** - A unit of measure of angles is also equal to  $1/360$  of a complete circle.

**diagonal** - A line segment connecting two nonadjacent vertices of a polygon.

**equilateral triangle** - A triangle with all three sides the same length.

**exterior angle** - An angle at a vertex of a polygon where the sides of the angle are one side of the polygon and the extension of the other side meeting at that vertex.

**interior angle** - The angle inside a polygon formed by two adjacent sides of the polygon.

**irregular polygon** - A polygon which has at least two sides with different lengths or two angles with different measures.

**isosceles triangle** - A triangle with two sides the same length.

**line of symmetry** - A line such that if a shape is folded over this line the two halves of the shape match exactly.

**line segment** - A line segment consists of two points of a line and all the points between these two points.

**midpoint** - The point that divides a line segment into two segments of equal length.

**obtuse angle** - An angle whose measure is greater than  $90^\circ$  and less than  $180^\circ$ .

**parallel lines** - Lines in a plane that never meet. The opposite sides of a regular hexagon are parallel.

**parallelogram** - A quadrilateral with opposite sides parallel.

**perpendicular lines** - Two lines that intersect to form right angles.

**polygon** - A shape formed by line segments, called *sides*, so that each of the segments meets exactly two other segments, and all of the points where the segments meet are endpoints of the segments.

**quadrilateral** - A polygon with four sides.

**ray** - A part of a line consisting of a point, called an endpoint, and all the points on the line on one side of the endpoint.

**rectangle** - A parallelogram with all right angles. Squares are a special type of rectangle.

**reflection symmetry** - A shape with reflection symmetry has two halves that are mirror images of each other.

**regular polygon** - A polygon that has all of its sides equal and all of its angles equal.

**rhombus** - A quadrilateral that has all sides the same length.

**right angle** - An angle that measures  $90^\circ$ . A rectangle has four right angles.

**right triangle** - A triangle with one right angle and two acute angles.

**rotation symmetry** - A shape has rotation symmetry if it can be rotated less than a full turn about its center point to a position where it looks exactly as it did before it was rotated.

**scalene triangle** - A triangle with no side lengths equal.

**square** - A rectangle with all sides equal. Squares have four right angles and four equal sides.

**straight angle** - An angle that measures  $180^\circ$ .

**tiling/tessellation** - The covering of a plane surface with geometric shapes without gaps or overlaps.

**transversal** - A line that intersects two or more lines.

**trapezoid** - A quadrilateral with at least one pair of opposite sides parallel.

**vertex** - A corner of a polygon.

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## Unit 1 - Goals

- Sort shapes according to some special properties and describe these properties
- Introduce students to rotation and reflection symmetries of figures
- Decide what shapes will tile a surface and what common properties these shapes may have

## Unit 2 - Goals

- Use and develop benchmarks to estimate the size of angles
- Increase the ability to reason with shapes
- Practice measuring angles and realize when precision in measurement is important.
- Realize that as the sides of an angle are extended, the angle size or the amount of the turn does not change, but the distance between the two sides does change
- Explore the patterns among angles created when two or more parallel lines are cut by another line
- Develop a better understanding of parallel lines and parallelograms

## Unit 3 - Goals

- Find angle sums of polygons
- Determine relationships between the number of sides and the angle sum of a regular polygon
- Form conjectures about the relationship between the number of sides and the angle sum of any polygon
- Decide which regular polygons will tile by themselves or in combinations using information about interior angles
- Explore the sum of the exterior angles of a polygon

## Unit 4 - Goals

- Decide whether any three side lengths will make a triangle
- Find that the sum of two side lengths of a triangle must be greater than the third side length
- Decide whether any four side lengths will make a quadrilateral
- Find that the sum of three side lengths of a quadrilateral must be greater than the fourth side length.
- Use properties of quadrilaterals to make specific quadrilaterals



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## 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.

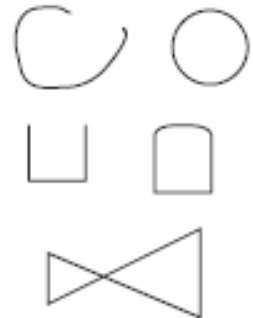
### Polygon Names

- 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

### Polygons



### Not polygons



### Regular Polygons

Polygons whose side lengths are equal and interior angle measures are equal.



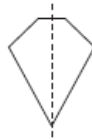
### Irregular Polygon

A polygon that has either at least 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.



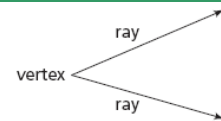
### Rotational (or Turn) Symmetry

A polygon with turn symmetry can be turned around its center point less than a full turn and still look exactly as it did before it was rotated.



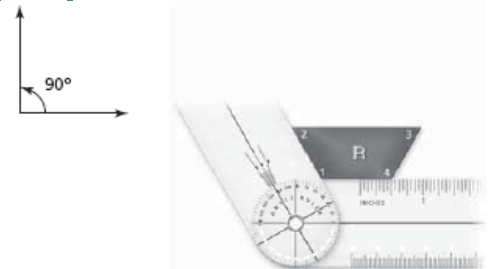
### Angles

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

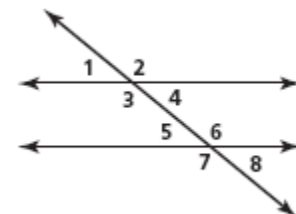
To develop estimation skills, students relate angles to right angles. Combinations and partitions of  $90^\circ$  are used as benchmarks to estimate angle size.



A **goniometer** (goh nee AHM uh tur), or **angle ruler**, is an instrument for making more precise measurements of angles. This tool is used in the medical field for measuring angle of motion or flexibility in body joints, such as knees.

### Angles and Parallel Lines

Parallel lines cut by a **transversal** make pairs of equal corresponding angles and pairs of equal alternate interior angles. Angles 1 and 5, angles 2 and 6, angles 3 and 7, and angles 4 and 8 are pairs of **corresponding angles**. Angles 4 and 5 and angles 3 and 6 are pairs of **alternate interior angles**.



### 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:  $a + b > c$ ,  $b + c > a$ ,  $c + a > b$