



Using Coffee Stirrers to Develop and Test Geometric Concepts

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Topics to be discussed

1. NCTM Standards for Geometry in grades 3-5
2. van Hiele Levels
3. Sorting two-dimensional shapes
4. Exploring polygons
5. Angles and Triangles
6. Special types of quadrilaterals
7. Testing Conjectures
8. Let's build three dimensional figures

Presentation available: <https://sites.google.com/site/carolynwhitenctm2013/>



Polygons Vocabulary

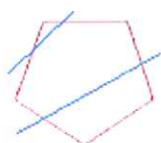
Side - one of the line segments that make up the polygon.

Vertex - point where two sides meet. Two or more of these points are called vertices.

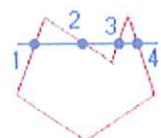
Diagonal - a line segment connecting any two non-consecutive vertices of a polygon

Interior Angle - Angle formed by two adjacent sides inside the polygon.

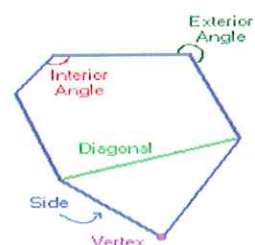
Exterior Angle - Angle formed by two adjacent sides outside the polygon.



Convex - a straight line drawn through a convex polygon crosses at most two sides. Every interior angle is less than 180° .



Concave - you can draw at least one straight line through a concave polygon that crosses more than two sides. At least one interior angle is more than 180° .



Polygon Names

Generally accepted names

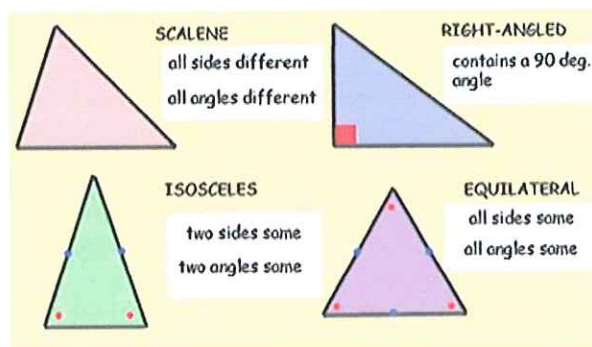
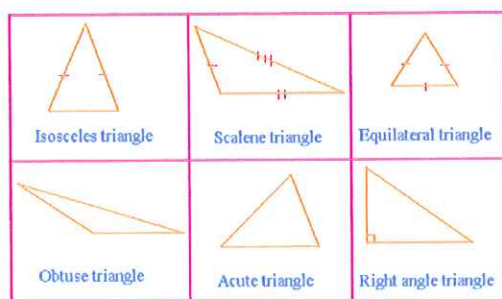
Sides Name

n	N-gon
3	Triangle
4	Quadrilateral
5	Pentagon
6	Hexagon
7	Heptagon
8	Octagon
10	Decagon
12	Dodecagon

Sides Name

9	Nonagon, Enneagon
11	Undecagon, Hendecagon

Triangles



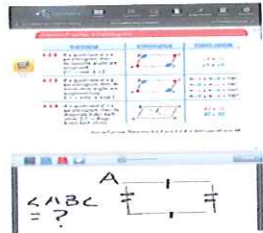
Geometry APPS

Geoboard APP in I tunes Price: Free Size 4.7B Seller: Clarity Innovations, Inc. © 2012 The Math Learning Center



Students use virtual pegs with rubber bands stretched around them to learn and explore concepts in geometry. Multiple concepts can be explored on the same peg board using different colors of rubber bands. The Geoboard App is fun for all ages.

HMH Fuse: Geometry, Common Core One Free Chapter



Geometry Pad for Android Tablets in Goggle Play: Free Size 14M



Geometry Pad is a dynamic geometry application for Android tablets with universal appeal. Teachers can use it in a geometry class for better students engagement and deeper understanding of geometric concepts. Easily create complex geometric sketches, measure everything you have in your document, experiment with shapes and transformations.

Literature Selections

Title	Author	Title	Author
<i>Angles are as Easy as Pie</i>	Froman, Robert	<i>Sea Shapes</i>	MacDonald, Suse
<i>Arrow to the Sun</i>	McDermott, Jerald	<i>Shadows & Reflections</i>	Hoban, Tana
<i>Greedy Triangle, The</i>	Burns, Marilyn	<i>Triangles & ..Polygons</i>	Adler, David
<i>Geometry for Every Kid</i>	Van Cleave, Janice	<i>Shape of Things</i>	Dodds, DayleAnn
<i>M is for Mirror</i>	Birmingham, Duncan	<i>Shapes</i>	Reiss, John
<i>Listen to a Shape</i>	Brown, Marcia	<i>Shapes</i>	Yenawine, Philip
<i>Missing Piece, The</i>	Silverstein, Shel	<i>Shapes, Play the Game</i>	Browne, Anthony
<i>Patchwork Quilt</i>	Flournoy, Valerie	<i>Shapes, Shapes, Shapes</i>	Hoban, Tana
<i>Quilt, The</i>	Jonas, Ann	<i>Village of Round and Square Houses</i>	Grifalconi, Ann
<i>Quilt Story</i>	Johnston, Tony	<i>When a Line Bends, A Shape Begins</i>	Greene, Rhonda

Bibliography

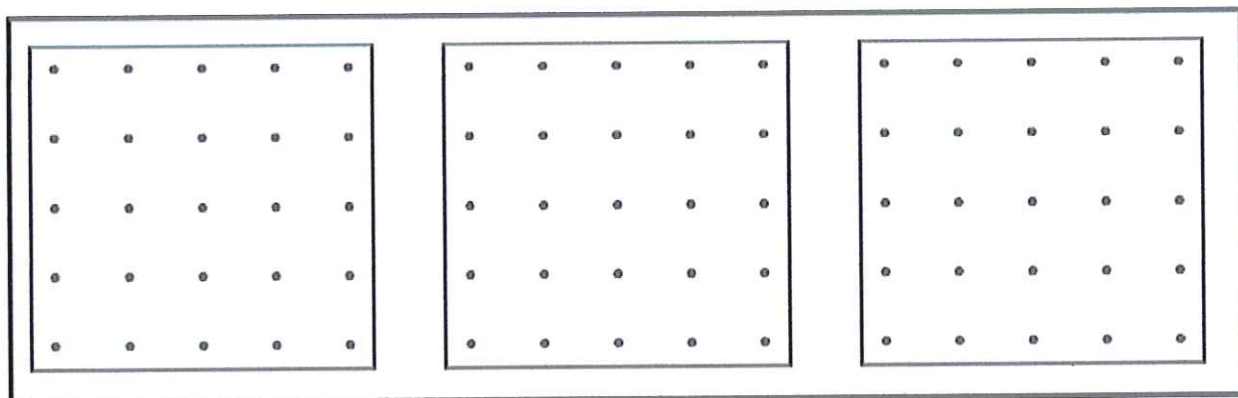
Burns, Marilyn. *The Greedy Triangle*. New York, NY: Scholastic INC, 1994.

Erickson, Tim. *Get It Together Math Problems for Groups*. Berkeley, CA: Lawrence Hall of Science, 1989.

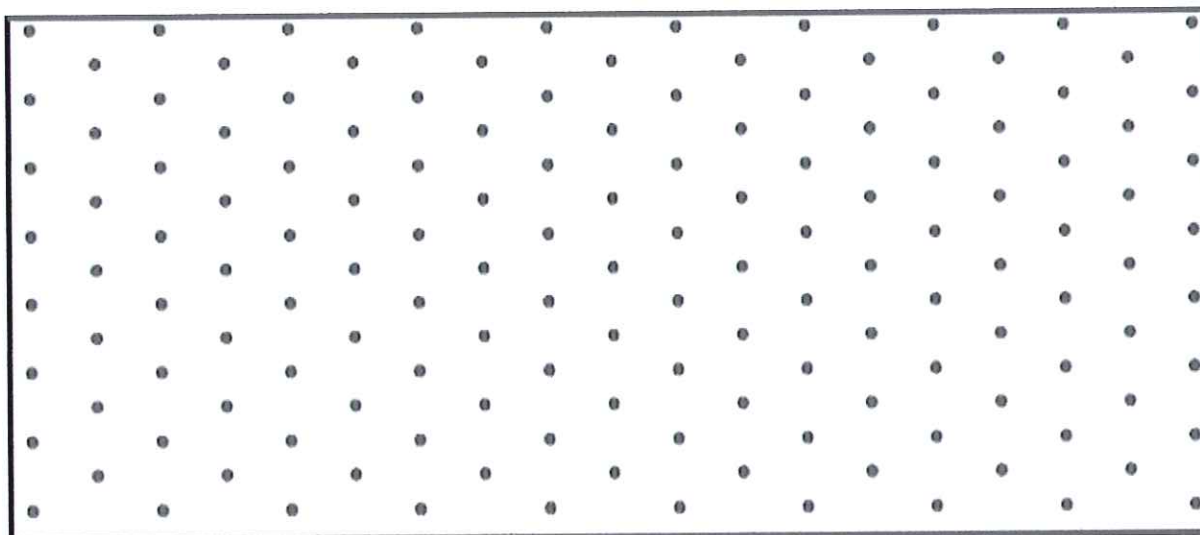
The National Council of Teachers of Mathematics Principles and Standards for School Mathematics.
Reston, VA: NCTM, 2000.

Angles and Triangles

5 x5 Geoboard Paper



Isometric Paper



Investigation with Angles

- Using Coffee Stirrers with one chenille stick to make a: right angle, acute angle, straight angle, obtuse angle and reflex angle

Investigations with Triangles

- Identify real world examples of triangles and explore what triangles have in common.
- Is it possible to make a three-sided polygon that is not a triangle?
- Make different types of triangles: isosceles triangle, obtuse triangle, scalene triangle
- Make a right triangle using coffee stirrers. Is it possible to make a triangle with two right angles?
- Make an equilateral triangle using coffee stirrers. Is it possible to make an equilateral triangle on a 5 x 5 Geoboard? Is it possible to make an equilateral triangle on isometric paper?

Stick Figures 1

There are twelve sticks in the figure. The sticks are unbroken and they don't overlap.

Make the figure!



Stick Figures 1

There are eight sticks in the square.

Make the figure!

Stick Figures 1

There are four sticks in the interior of the square.

All of the sticks are the same length.

Make the figure!

Stick Figures 1

There are six sticks in the triangle.

Make the figure!

Stick Figures 1

The triangle and the square share a side.

Make the figure!

Stick Figures 1

In the figure, both the rectangle and the triangle are regular polygons.

Make the figure!

Stick Figures 2

There are fifteen sticks in all;
the two triangles in the figure
share a side.

Make the figure!

Stick Figures 2

The longest segment in the
figure is two sticks long.

All of the sticks are the same
length.

Make the figure!



Stick Figures 2

Both triangles in the figure are
isosceles, but only one is
equilateral.

Make the figure!

Stick Figures 2

The square shares a side with
only one of the triangles.

Make the figure!

Stick Figures 2

Six of the sticks in the figure
are in neither of the triangles.

Make the figure!

Stick Figures 2

The figure has two triangles
and one square; all the sides
are either one or two sticks
long (no broken sticks!).

Make the figure!

Stick Figures 3

There are twelve sticks in the figure. The sticks are unbroken and they don't overlap.

Make the figure!



Stick Figures 3

The figure is made up of two triangles that are not congruent.

Make the figure!

Stick Figures 3

One triangle has a perimeter of seven sticks.

Make the figure!

Stick Figures 3

No segment in the figure is shorter than two sticks.

Make the figure!

Stick Figures 3

The two triangles share a side.

Make the figure!

Stick Figures 3

There is a quadrilateral in the figure that has a perimeter of nine.

Make the figure!

Stick Figures 4

There are eleven sticks in the figure. The sticks are unbroken and they don't overlap.

Make the figure!



Stick Figures 4

No sticks fall outside the pentagon.

Make the figure!

Stick Figures 4

All of the triangles are equilateral, but the pentagon isn't.

All of the sticks are the same length.

Make the figure!

Stick Figures 4

There are four triangles in the figure.

Make the figure!

Stick Figures 4

Each triangle shares sticks with two others.

Make the figure!

Stick Figures 4

One of the triangles is larger than the other three.

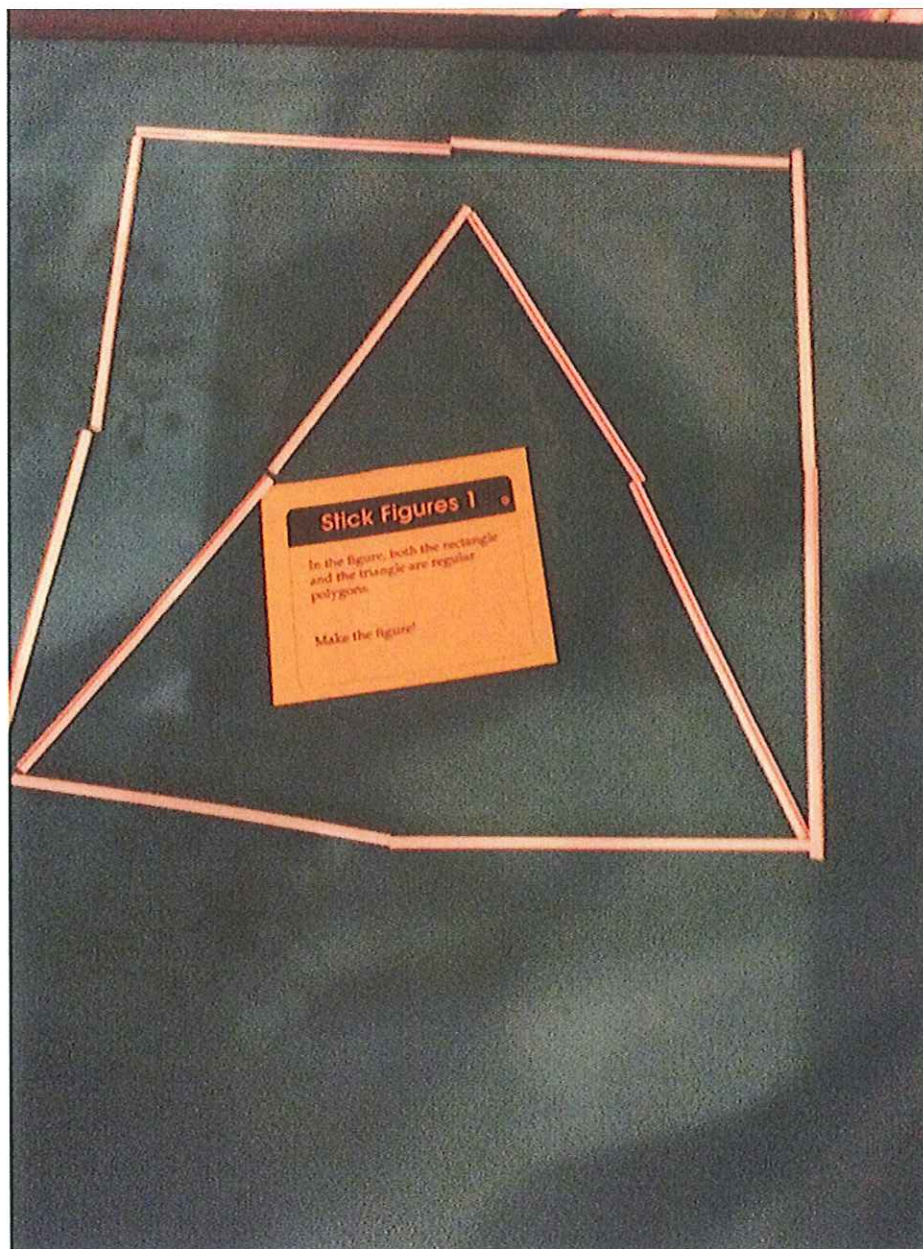
Make the figure!

Two-Dimensional Shapes Challenge

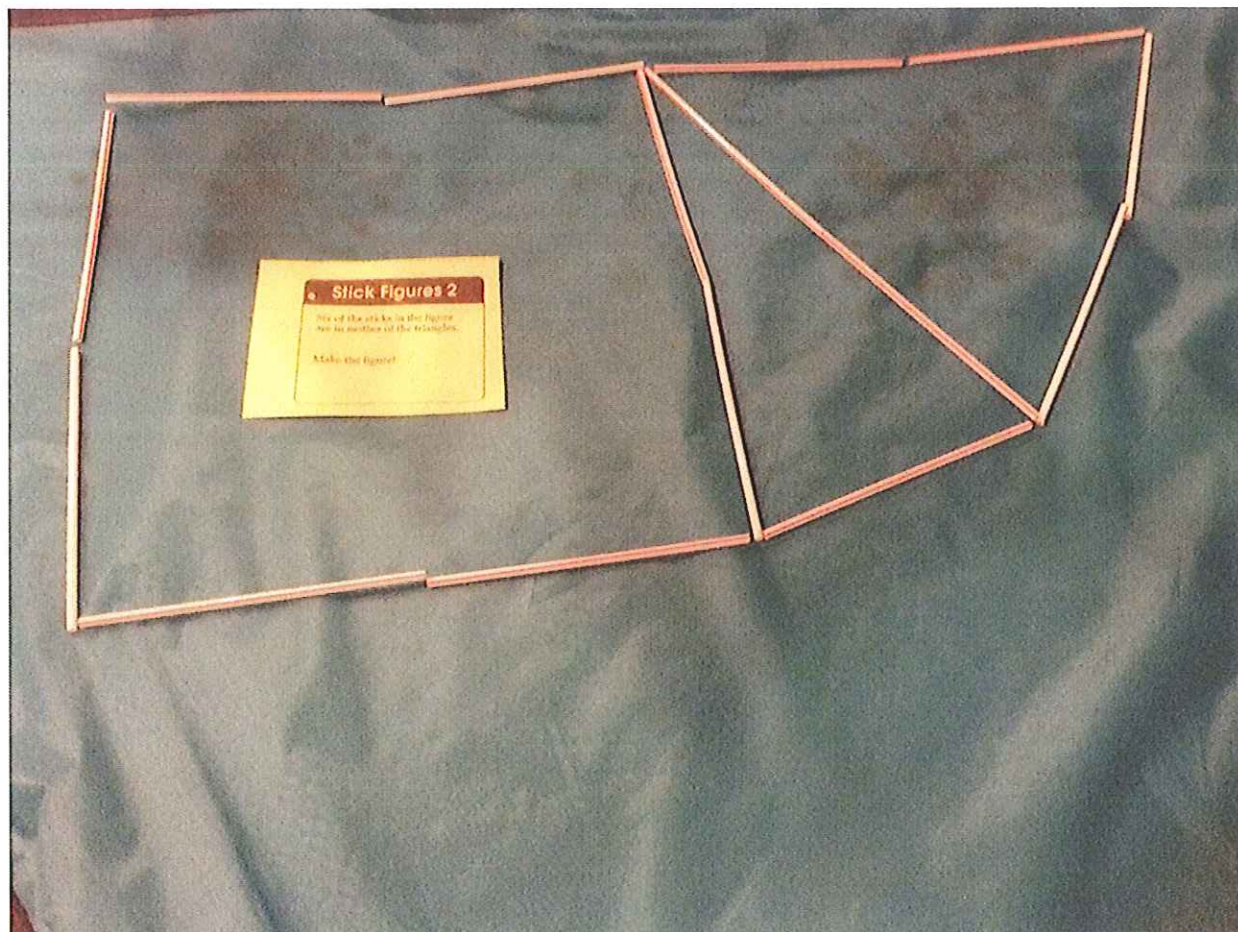
Build a:

- 1. triangle with two congruent sides**
- 2. a rectangle with four congruent sides**
- 3. a parallelogram with four congruent sides**
- 4. a closed figure with five sides**
- 5. a triangle with a right angle**
- 6. shapes that are congruent**
- 7. a triangle with an angle whose measure is larger than the measure of a right angle**
- 8. a quadrilateral with exactly one pair of parallel sides**
- 9. a shape with six lines of symmetry**
- 10. a shape with three lines of symmetry**

Stick Figures 1



Solution to Stick Figures 2



Stick Figures 3



Stick Figures 4

