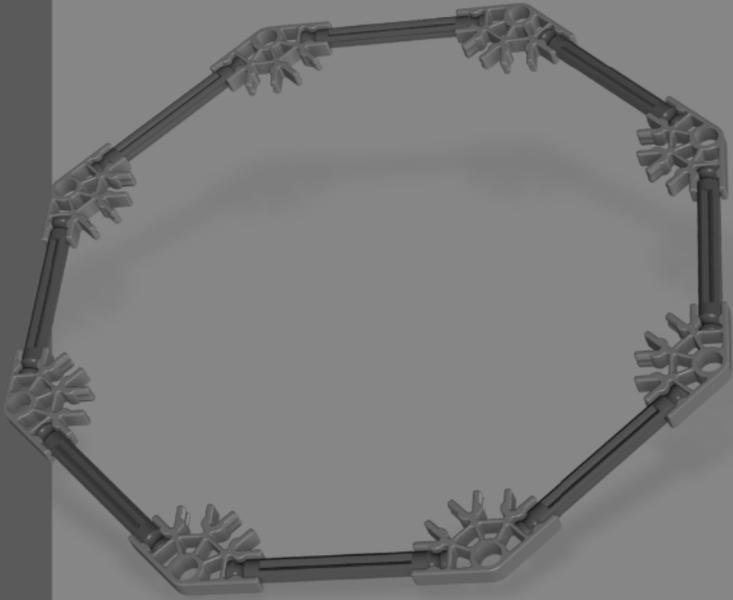


# KNEX<sup>®</sup>

# Education

## TEACHER'S GUIDE™

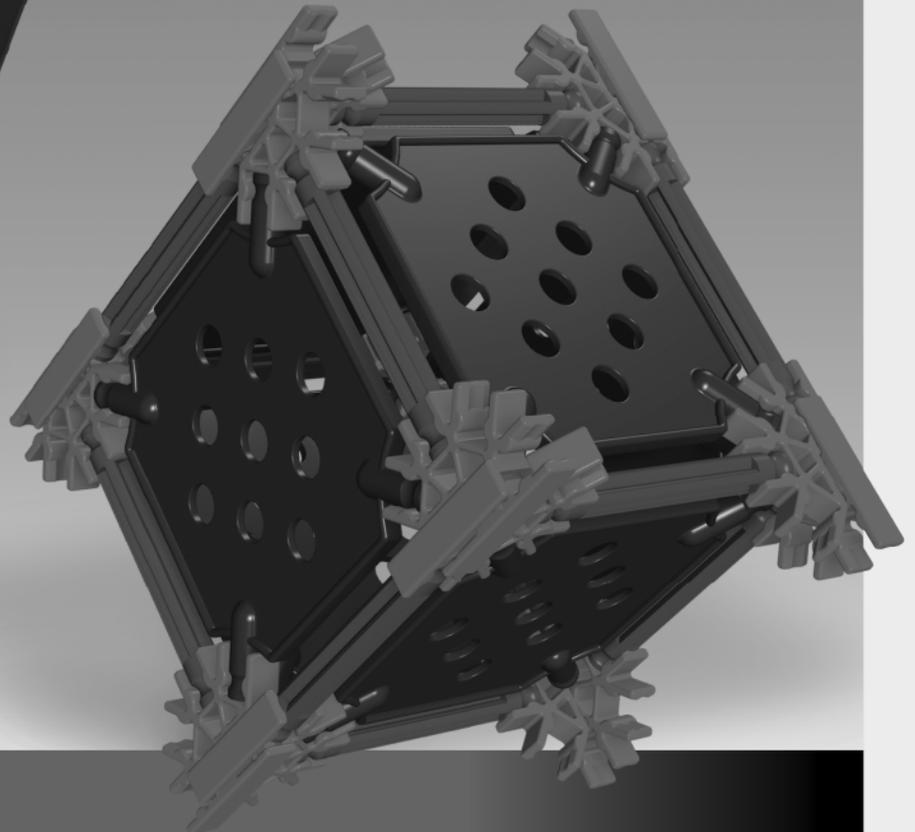
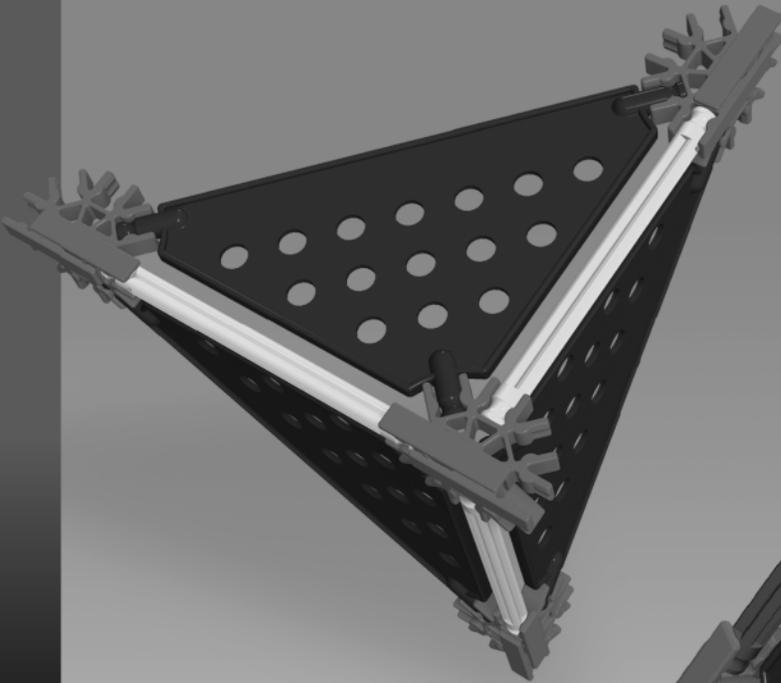
### ELEMENTARY MATH AND GEOMETRY™



**OCTAGON**



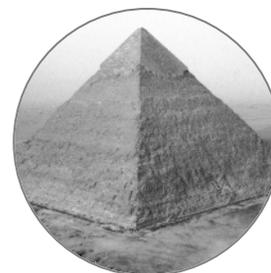
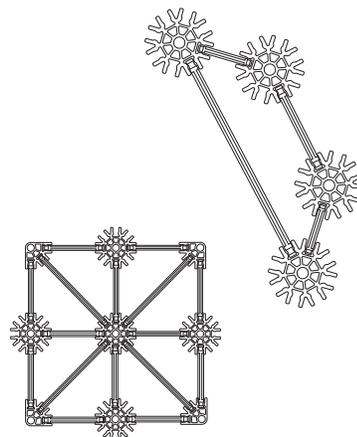
**3-D SHAPES**





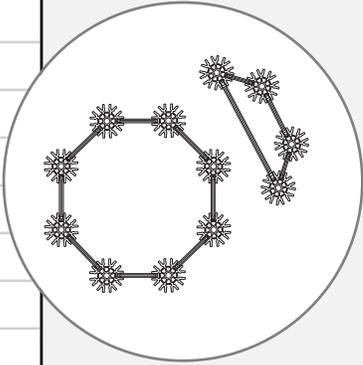
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# Lesson 1:

# Introductory Activity



**Time**  
45 minutes – 1 hour

### Objectives

The students will be able to:

- Explore shapes using selected K'NEX pieces
- Construct as many different shapes as possible using the K'NEX pieces
- Draw the shapes using the constructed K'NEX models
- Develop vocabulary to describe the shapes

### Materials

Each group of students will need from their K'NEX Math and Geometry set:

- 24 white Connectors
- All the Rods in the set: 12 each of the red, blue and white Rods, 8 yellow Rods, 1 gray Rod

### Each student will need:

- Sheets of 8.5" x 11" paper
- Ruler and pencil
- Student Journals (optional)

### You will need:

- 1 roll of butcher paper
- Vocabulary cards (optional)

### Vocabulary

triangle, square, rectangle, rhombus, parallelogram, trapezoid, quadrilateral, pentagon, hexagon, octagon

### Teacher's Notes:

Only 1 square, rectangle, rhombus, etc. should be made by each group, even though a number of different sized squares, rectangles, rhombi, etc. can be made from the materials.

Some of the figures that the children construct may be too large for a standard 8.5" x 11" piece of paper. Have a roll of butcher paper available for the students to use for these larger figures.

You may want each member of the group to have his/her own set of shapes drawn on paper; alternatively there can be one set of drawings per group. If you decide on a group set of shapes, make sure that group members take turns recording the shapes on paper.

### Procedure:

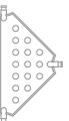
1. Have each group of students arrange the 24 white Connectors and all the Rods from their set on their desk/working area. Instruct the students to use the pieces of K'NEX to make as many different closed, 2-D shapes as they can.

2. Once constructed, students should draw each shape using the following process:

- Place the shape on a blank sheet of paper and hold it firmly in place.
- Place a pencil point into the center hole of each white Connector and make a mark.
- Remove the K'NEX shape from the paper.
- Using a ruler, connect the dots to create the shape on paper.



pyramid



triangle

angles

90°

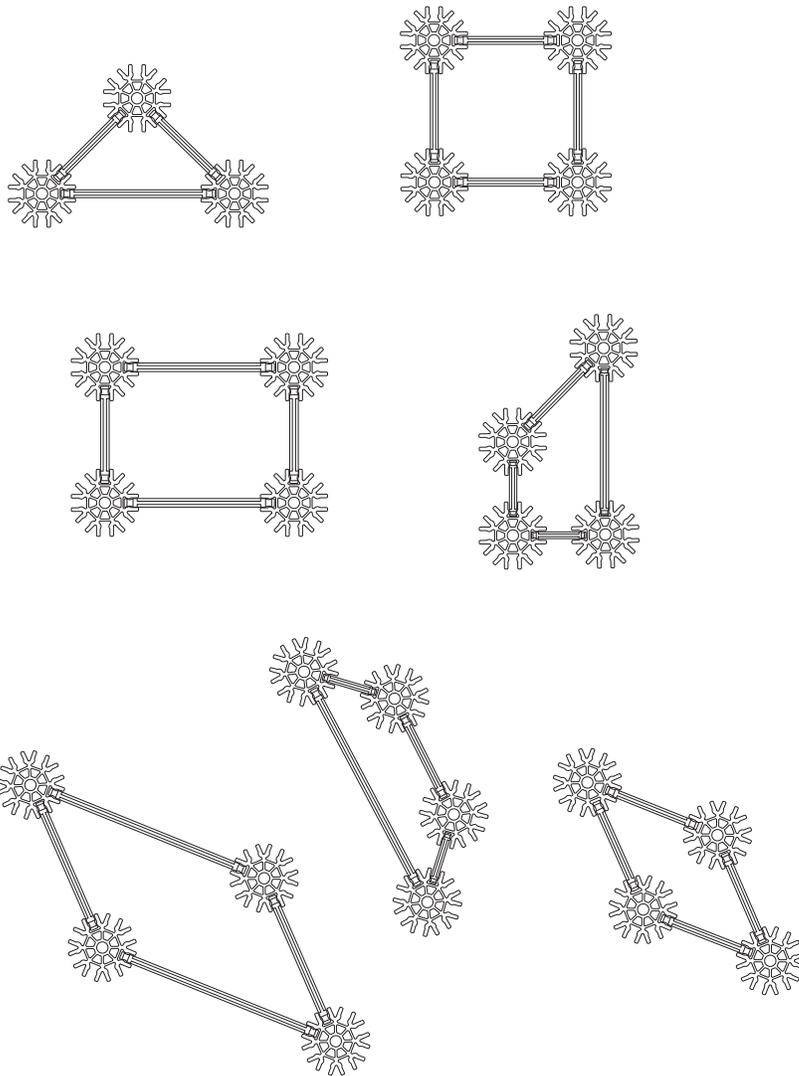
symmetry

p a t t e r n



line

- Once the shapes are recorded, the students can start to identify them. They may draw on their past experience for the names, but be prepared to help students identify some of the shapes they have constructed. The students will then label their drawings.
- You may want to introduce the vocabulary cards at this time, along with the journal. Alternatively, because this is an introductory lesson, you may want to save these for another time.
- Review the shapes that the students may have collectively constructed and identified. The following shapes can be made from the Connectors and Rods: **triangle, square, rectangle, rhombus, parallelogram, trapezoid, quadrilateral, pentagon, hexagon, and octagon.**



**Teacher's Notes:** There may be different sizes of many of the same figures represented in the children's drawings. These drawings can be used at a later time when you classify figures and when you discuss congruence and similarity.

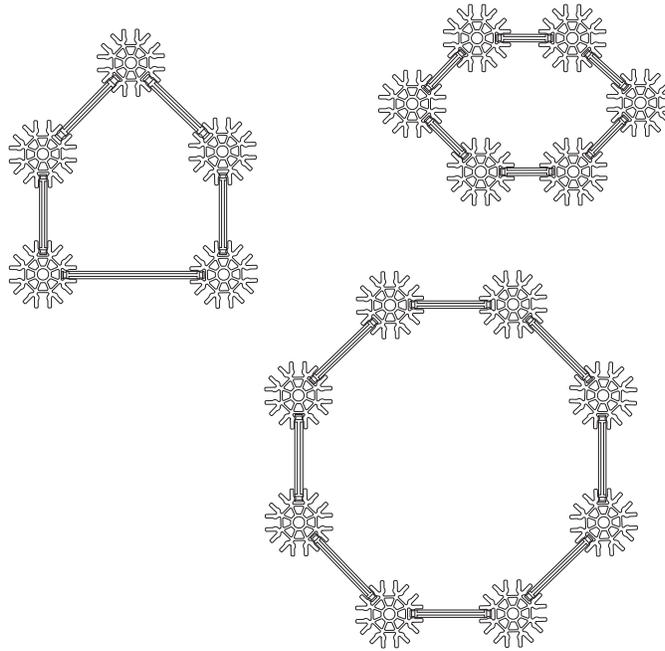
rectangle

Introduction

t-square

# Introductory Activity

line



rectangle

## Assessment

The drawings should be collected so that you can check each group's ability to translate their knowledge and understanding into action. Questions to consider:

- How many different kinds of shapes did each group make?
- Did they repeat any of the shapes?
- Is each shape labeled properly?

## Extension

- How many different four-sided shapes can you make?
- Make drawings of them.
- Keep these in a folder for later use.

t-square

# NCTM Standards Alignments

## Concepts, skills and knowledge development correlations with the National Council of Teachers of Mathematics Education Standards

### GEOMETRY

- *Apply transformations and use symmetry to analyze mathematical situations.*

### PROBLEM SOLVING

- *Build new mathematical knowledge through problem solving.*
- *Apply and adapt a variety of appropriate strategies to solve problems.*

### 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.*

### REPRESENTATION

- *Create and use representations to organize, record, and communicate mathematical ideas.*

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# Common Core Standards Alignments

## Common Core State Standards for Mathematics in Grades 1 - 3

### MATHEMATICAL PRACTICES - ASSOCIATED WITH MATHEMATICS AT ALL GRADE LEVELS

1. *Make sense of problems and persevere in solving them*
2. *Reason abstractly and quantitatively.*
3. *Construct viable arguments and critique the reasoning of others.*
4. *Model with mathematics.*
5. *Use appropriate tools strategically.*
6. *Attend to precision.*
7. *Look for and make use of structure.*
8. *Look for and express regularity in repeated reasoning.*

### MATHEMATICS - GRADE 1

In Grade 1, instructional time should focus on four critical areas:

- *Reasoning about attributes of, and composing and decomposing geometric shapes.*

Details

- *Students compose and decompose plane or solid figures (e.g., put two triangles together to make a quadrilateral) and build understanding of part-whole relationships as well as the properties of the original and composite shapes. As they combine shapes, they recognize them from different perspectives and orientations, describe their geometric attributes, and determine how they are alike and different, to develop the background for measurement and for initial understandings of properties such as congruence and symmetry.*

### GRADE 1

**Geometry** - Reason with shapes and their attributes.

1. *Distinguish between defining attributes (e.g., triangles are closed and three-sided) versus non-defining attributes (e.g., color, orientation, overall size); build and draw shapes to possess defining attributes.*
2. *Compose two-dimensional shapes (rectangles, squares, trapezoids, and triangles) or three-dimensional shapes (cubes and right rectangular prisms) to create a composite shape, and compose new shapes from the composite shape.*
3. *Partition rectangles into two and four equal shares, describe the shares using the words halves, fourths, and quarters, and use the phrases half of, fourth of, and quarter of. Describe the whole as two of, or four of the shares. Understand for these examples that decomposing into more equal shares creates smaller shares.*

### MATHEMATICS - GRADE 2

In Grade 2, instructional time should focus on four critical areas:

- *Describing and analyzing shapes.*

Details:

- *Students describe and analyze shapes by examining their sides and angles. Students investigate, describe, and reason about decomposing and combining shapes to make other shapes. Through building, drawing, and analyzing two- and three-dimensional shapes, students develop a foundation for understanding area, volume, congruence, similarity, and symmetry in later grades.*

### GRADE 2

**Geometry** - Reason with shapes and their attributes.

- *Recognize and draw shapes having specified attributes, such as a given number of angles or a given number of equal faces. Identify triangles, quadrilaterals, pentagons, hexagons, and cubes*
- *Partition a rectangle into rows and columns of same-size squares and count to find the total number of them.*



- Partition rectangles into two, three, or four equal shares, describe the shares using the words halves, thirds, half of, a third of, etc. and describe the whole as two halves, three thirds, four fourths. Recognize that equal shares of identical wholes need not have the same shape.

### MATHEMATICS - GRADE 3

In Grade 3, instructional time should focus on four critical areas:

- Developing understanding of the structure of rectangular arrays and of area.
- Describing and analyzing two-dimensional shapes.

#### Details

- Students recognize area as an attribute of two-dimensional regions. They measure the area of a shape by finding the total number of same-size units of area required to cover the shape without gaps or overlaps, a square with sides of unit length being the standard unit for measuring area.
- Students describe, analyze, and compare properties of two-dimensional shapes. They compare and classify shapes by their sides and angles, and connect these with definitions of shapes. Students also relate their fraction work to geometry by expressing the area of part of a shape as a unit fraction of the whole.

### GRADE 3

**Measurement and Data** - Geometric measurement: understand concepts of area and relate area to multiplication and to addition.

1. Recognize area as an attribute of plane figures and understand concepts of area measurement.

a. A square with side length 1 unit, called “a unit square,” is said to have “one square unit” of area, and can be used to measure area.

2. Measure areas by counting unit squares (square cm., square m., square in., square ft., and improvised units).

3. Relate area to the operations of multiplication and addition.

a. Find the area of a rectangle with whole-number side lengths by tiling it, and show that the area is the same as would be found by multiplying the side lengths.

b. Multiply side lengths to find areas of rectangles with whole number side lengths in the context of solving real world and mathematical problems, and represent whole-number products as rectangular areas in mathematical reasoning.

**Geometry** - Reason with shapes and their attributes.

1. Understand that shapes in different categories (e.g., rhombuses, rectangles, and others) may share attributes (e.g., having four sides), and that the shared attributes can define a larger category (e.g., quadrilaterals). Recognize rhombuses, rectangles, and squares as examples of quadrilaterals, and draw examples of quadrilaterals that do not belong to any of these subcategories.

2. Partition shapes into parts with equal areas. Express the area of each part as a unit fraction of the whole. For example, partition a shape into 4 parts with equal area, and describe the area of each part as  $\frac{1}{4}$  of the area of the shape.

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