Math 6 - Act. 13: Constructing Tangrams

Summary

This activity provides a connection between geometry and algebra by looking at geometric concepts in a coordinate plane. In addition, it draws upon an ancient Chinese legend and culture to add interest to the context of the lesson.

Materials

- Graph paper
- Colored markers
- Ruler
- Extra set of tangrams
- Overhead set of tangrams
- Poster-size graph paper
- Scissors
- Envelopes
- Pencil

Additional Resources

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Kaleidoscope Math by Joe Kennedy and Diane Thomas (Creative Publications) *Twenty Thinking Questions for Pattern Blocks* (Grades 6-8) (Creative Publications), *Geometry and Fractions with Tangrams Learning Resources* (Grades 3-6) by Barbara Bando Irvin

Background for Teachers

As they construct the tangrams, students are required to graph points defined by ordered pairs in the four quadrants and write the ordered pair for a given point in any one of the four quadrants. They are also required to identify midpoints of line segments. Once the tans are constructed, students can explore a variety of other mathematical concepts related to geometry, measurement, and fractions (e.g., transformations in a plane and area of geometric shapes).

The main lesson itself provides meaningful learning opportunities, but the possible extensions enrich the depth of the mathematical learning by connecting the geometry to concepts of measurement, fractions, decimals, and percents.

Intended Learning Outcomes

3. Reason mathematically.
5. Make mathematical connections.

Instructional Procedures

Invitation to Learn

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Share the story of the tangram. According to legend, the tangram puzzle originated in China. The legend tells of Tan, a Chinese nobleman, who wished to present the emperor with a gift of an exquisite square tile. Unfortunately, he dropped the tile on his journey and broke it into pieces. When he opened the bag he was carrying it in, he found that the tile broke into exactly 7 pieces--5 right triangles (2 small, 2 large, and 1 medium), a square, and a parallelogram. Tan tried to put the pieces back together to reconstruct the square tile, but he could not. What he found, however, was that he could make many other shapes with the seven pieces. He decided that the broken pieces made an even grander gift than his original square tile.

Although it is not known exactly when tangrams came about, we know that they became quite popular in the United States and Europe during the nineteenth century and have remained popular among geometry enthusiasts today.

Instructional Procedures:

- Explain that the tangram consists of seven special geometric shapes. Each student will construct a set of tangrams through paper folding and cutting. Then each student will construct a set of tangrams on a coordinate system.
- Explain the instructions and distribute materials for the activity (see handout for reference).
- Allow time for students to construct a set of tangrams following the directions given on the handout.
- Once students have constructed tangrams, they will use their tangram set, along with a second set handed out by the teacher, to answer a variety of extension questions related to measurement, fractions, and transformations. Divide the students into small groups and give each group a different task to complete. Have the groups share findings from the task they were asked to explore.
- Lead a closing discussion.

Curriculum Integration

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Math/Puzzles; Geometry and other Math; Literature -- The tangrams the students construct can be used to explore a variety of mathematical concepts: fractions, decimals, percents, area, and transformational geometry.

There is a wonderful book called *Grandfather Tang's Story* that tells about a man sharing a story of a variety of animals. As each animal is introduced, Grandfather Tang rearranges the tangram pieces to illustrate the next animal in the story.

Strategies for Diverse Learners

The original activity can be done without using the coordinate plane.

Exploring the topic of tessellations in more detail would be a rich opportunity here. Students can look at tessellation concepts in art (e.g., MC Escher) as well as in the real world (e.g., honeycomb structures).

Extensions

- Let the original tangram be equal to one whole unit. Find the fractional part of the whole represented by each of the tans.
- The same task can be repeated by having the students find the decimal representation and/or percentage each tan represents of the whole.
- Orient the tans on a coordinate plane and direct students to transform the shape by translation along a line (perpendicular or parallel to an axis), rotation around a point (such as the vertex of the shape), or reflecting about an axis.
- Explore line symmetry in more detail using single mirrors (see handout for line symmetry in alphabet letters).

Home & Family Connections

Have students take their tangrams home and create additional shapes.

Assessment Plan

Observe as students work with the instructions for constructing the tangram. The completed tangram and completed worksheet can serve as formal assessment strategies. Students could create a kite design using reflection symmetry and record their design in a coordinate plane. Students could then construct their design, connecting it to art.

Authors

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