Math 3 - Act. 14: Tetrominoes Cover-Up

Main Core Tie

Mathematics Grade 3
Strand: GEOMETRY (3.G) Standard 3.G.1

Materials

For each pair of students:
    Two copies of Tetrominoes Cover-Up Game Board
    A "Tetrominoes Die"
    One inch square tiles
    Crayons, markers, scissors, glue
For the classroom:
    Overhead projector
    Overhead transparency of "Tetrominoes Cover- Up Game Board"

Instructional Procedures

Engagement
    Hand out square tiles to pairs of students. Demonstrate on the overhead projector the rules for
    arranging the tiles:
        Each square must share a common side.
        Tiles must be laid flat; no stacking is allowed.
    Have the students use 4 squares to try to find as many two dimensional tetrominoes as
    possible.
    Students trace the shapes onto 1" grid paper and cut them out, checking for duplicate congruent
    shapes caused by rotations and flips. Demonstrate congruence by saying, "I can prove these
    are congruent by rotating," or "I can prove these are congruent by flipping."
    Discuss the class discoveries, using the following questions to guide students' thinking:
        Do you have all possible tetromino shapes?
        How do you know?
        Are some of the tetrominoes the same?
        How can you prove it? (By turning, flipping, or sliding the tetrominoes and placing them on
        top of each other, we can prove they are the same or different. They are the same when
        they fit exactly on top of each other, proving that they are the same size and shape.)
Exploration
:
    Students play "tetrominoes cover-up" with the tetrominoes they have just made. The object of
    the game is to completely cover up the 8 x 6 grid on the game board with their tetromino
    shapes. They are to try to have the least amount of uncovered squares with no overlapping.
    Hand out a die pattern and game board to each student and have them make their own die.
    When the die is rolled, the figure that appears on top is the tetromino to be used for that turn. A
    player whose roll shows a "Free Choice" may play a piece of his or her choice.
    Model on the overhead projector how to play the game. Each pair will decide who will go first.
    Player 1 rolls the die to determine a tetromino piece to play. They place the tetromino on their
    game board so that one side touches either the bottom of the game board or (after the first
    round) another tetromino. They may use slides, flips, or turns to place the selected tetromino so
    that the fewest squares will be left uncovered on the game board. The player then colors the
    squares that are covered by the selected tetromino.

Player 2 rolls the die to determine the tetromino to be placed on their game board. Play continues until no more tetrominoes can be placed on either game board. The players determine their scores by counting the total number of squares not covered on their own game board. The winner is the player with the lowest score.

Explanation

When all the students have played the game at least once, discuss with the whole class some strategies they have discovered. The following questions can be used to guide the discussion:

Do certain shapes fit together well?

How did you decide where to place the tetrominoes?

Was one tetromino shape more difficult to place than the others? Why?

What was the easiest tetromino shape to work with? Why?

Review the terms; translation (slide), reflection (flip), and rotation (turn).

Extension

A variation to the above game would be to use six sets of tetrominoes and only one game board. Instead of coloring squares on the game board, the students can take turns rolling to select a tetromino shape and then place the actual tetromino on the game board. When all the pieces of a certain shape have been used, the students either spin again or lose a turn. Play ends when no tetrominoes are left to play or none of the remaining shapes will fit on the playing region. The student that places the greater number of tetrominoes on the game board is the winner.

Explore playing the game with game boards of different sizes. Have the students determine which game board was more challenging and tell why.

Use several tetromino pieces of the same shape and see which tetrominoes tessellate or cover a surface without any gaps.

Students fold the tetrominoes they made to determine which tetromino pieces have symmetry. There may be more than one line of symmetry for some tetrominoes.

Students can determine area and perimeter of each tetromino shape.

Bibliography

Adapted from an activity described in: National Council of Teachers of Mathematics, (2001). *Navigating through Geometry in Grades 3-5*. Reston, VA: Key Curriculum Press.

Authors

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