SHIFTING SHAPES
TEACHER'S GUIDE

A 60–90-minute math activity for students in grades K–7.

Uses the *Neighborhood Hide & Seek* 🔗 game.

OBJECTIVES

- Students will be able to quickly add sets of numbers that sum to 20.
- Students will be able to find patterns in the areas of differing geometric shapes.
- Students will be able to use patterns in geometric shapes and their areas to create and solve challenging logic puzzles.

ABOUT THIS LESSON

Neighborhood Hide & Seek is a game that uses ten polyominoes of different shapes and areas to solve a series of puzzles. The various polyomino shapes have limitless arrangements which can be used to teach, introduce, or reinforce concepts such as counting principles, addition, area, and elementary geometry.

This activity is designed to fit seamlessly within a lesson or unit about one or more of these topics. It can easily be broken into segments and assigned over the course of such a unit, rather than all at once. You may even find it useful to break each individual question or task into daily lesson opener questions, culminating with a final task where students gradually create their own *Neighborhood Hide & Seek* mega-puzzle.

In this activity, students will deconstruct the game of *Neighborhood Hide & Seek* piece by piece, and learn how the properties of the shapes in the game guide how each puzzle is built.

MATH COMMON CORE STANDARDS CORRELATIONS

Kindergarten

- K.CC: Count to tell the number of objects.
- K.CC: Compare numbers.

1st Grade

- 1.OA: Represent and solve problems involving addition and subtraction.
- 1.OA: Add and subtract within 20.

2nd Grade

- 2.G.A.2: Partition a rectangle into rows and columns of same-size squares and count to find the total number of them.

3rd Grade

- 3.MD.C.5: Recognize area as an attribute of plane figures and understand concepts of area measurement.
- 3.MD.C.6: Measure areas by counting unit squares (square cm, square m, square in, square ft, and improvised units).

4th Grade

- 4.MD.A.3: Apply the area and perimeter formulas for rectangles in real world and mathematical problems.

Standards correlations continue at the end of the document.

Then they will have an opportunity to use that knowledge to build their own puzzles like those in *Neighborhood Hide & Seek*.

There are three distinct parts to this activity. Part 1 is the simplest and most attainable, even for kindergarten and 1st grade students, with assistance as needed. Part 2 builds on that foundation with tasks appropriate for students in grades 2–4 and higher. Part 3 is designed with 5th–7th grade skill levels in mind.

PROCEDURE

1. Hook

Begin the lesson by explaining the rules of *Neighborhood Hide & Seek*, and allow students to solve a few of the easier puzzles from the game. For this activity, there is no need to challenge the students too much with the higher difficulty level puzzles.

2. Instruction

Make sure students know how to "count the squares" for each shape in the game to find its area. Use a puzzle and place a shape piece on the grid, then allow students to count the squares that the shape covers. This skill is essential for this activity. Avoid front-loading too much more information for this activity. Instead, focus on helping students understand the tasks asked of them during the activity.

3. Student Activity Part 1: Basics

This part is fairly simple and should go quickly as long as students know how to count the squares to find the area of each shape. Give ample time for students to answer questions 6 and 8, giving assistance as needed.

4. Student Activity Part 2: Combos

If they need it, model for students how to do task 1. Once tasks 1 and 2 are complete, the rest are very similar in structure, but increase in difficulty. Encourage students to keep trying different combinations of shapes if they get stuck on any of the tasks. Remind students that they can count the areas of each shape to help them with each task — which is, after all, the point of these tasks.

5. Student Activity Part 3: Making Puzzles

In this part, students make their own puzzles. The instructions suggest using stick figures or emoji as characters, but feel free to use any theme you would like. You may consider showing examples of finished products in case students need a target in their mind of what they are making. Encourage students to decorate their puzzles with colored pencils, markers, or other materials to personalize them.

6. Conclusion

Review with students how knowing the area of each shape helped them navigate each of the tasks, and how knowing the sum of each combination of the shapes may help them come up with a way to create a puzzle of their own.

Assessment

Since this activity involves students creating their own puzzles to challenge one another, it lends itself well to peer grading. Alternatively, you can simply check that all the Part 1 questions are answered correctly, the Part 2 tasks are completed fully, and that the main components of their puzzle(s) are in place for Part 3.

If you use the questions and tasks from this activity as lesson openers, there is no need for formal assessment.

Extension Activities

- Expand Part 2 to include multiple groups of shapes that sum to all areas between 11 through 32. For example: Find a group of shapes that has a total area of 11, 12, 13, 14, 15, 16, 17, 18, etc.

- Have students make their own sets of polyominoes and see if they can answer the same questions from Part 1 and do the same tasks as Part 2.

- Expand Part 3 to have students make more puzzles of different total areas and shapes, such as a series of 3×3 puzzles, or 4×5, 4×6, 5×6, etc.

CHIP THEORY **Kids**
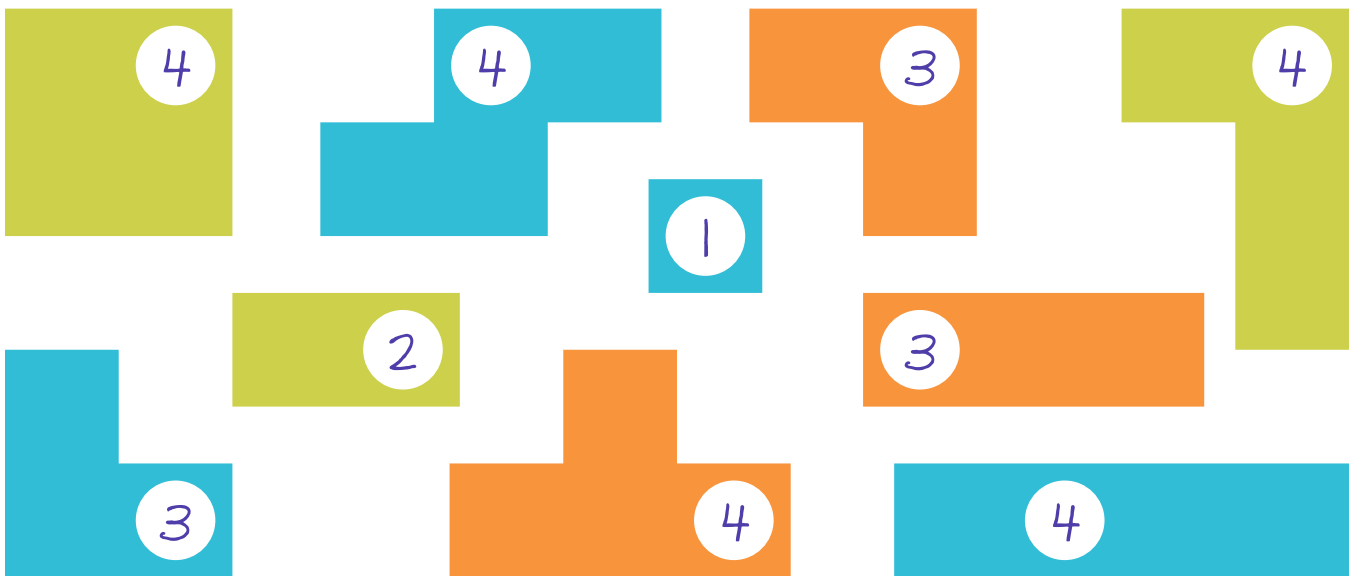
SHIFTING SHAPES
STUDENT HANDOUT

PART 1 - BASICS

1. Look at a Neighborhood Hide & Seek puzzle card. What is the total number of squares that can be covered up on a puzzle card?

   25

2. How many squares does each shape in Neighborhood Hide & Seek cover up? Write the number in the circle of each of the shapes below. These represent the area of each shape.

   4   **4**   **3**   **4**

   1

   2   **3**

   3   **4**   **4**

3. What is the total area of all the blue shapes?

   12

4. What is the total area of all the orange shapes?

   10

5. What is the total area of all the green shapes?

   10

CHIP THEORY Kids

6. *Can all of the shapes fit on one puzzle card? Why or why not?*

No. Because the number of squares of all the pieces add up to more than the number of spaces on a puzzle card.

Pick a Neighborhood Hide & Seek puzzle to solve. Then answer these questions.

7. **How many squares were covered up by the shapes to solve the puzzle?**

24

8. **Based on your answers above, can a Neighborhood Hide & Seek puzzle be solved with only two colors? Why or why not?**

No. The largest number of squares that can be covered with two colors is 22, which is not enough.

CHIP THEORY **Kids**

Build your skills by working on these challenges using the shape pieces from *Neighborhood Hide & Seek*.

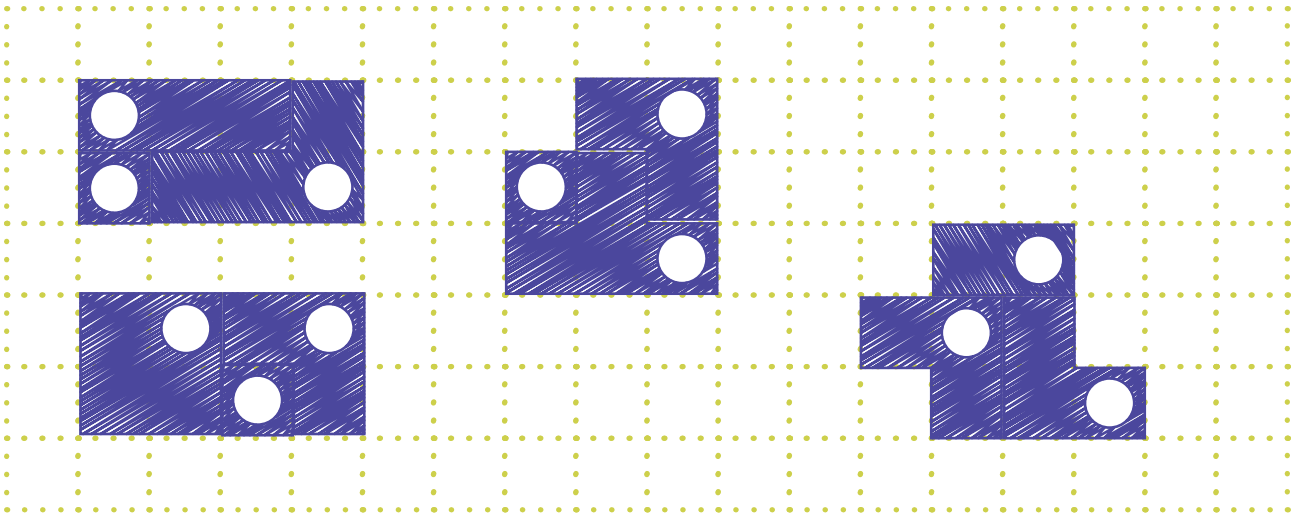1. **Choose a group of shapes that make a total area of 5. Draw them here.**
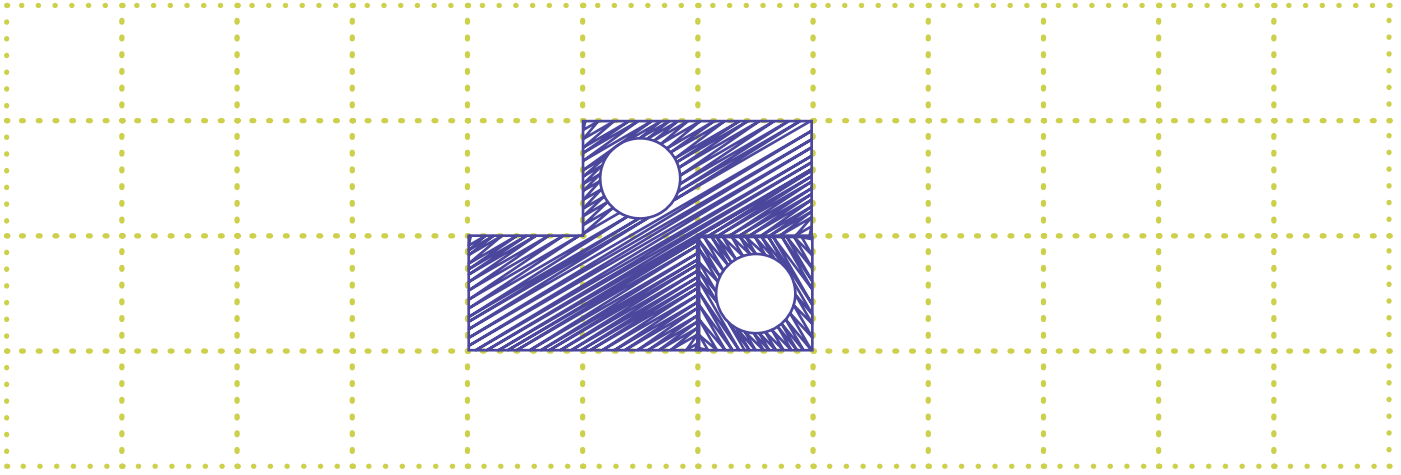
2. **What other groups of shapes can add up to an area of 5? Draw as many combinations as you can think of.**
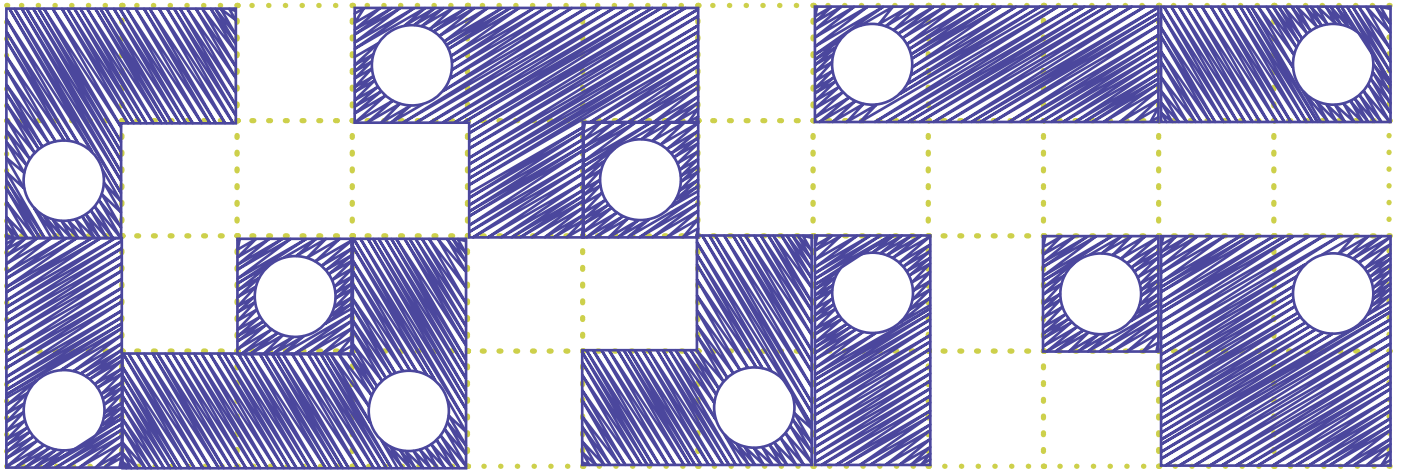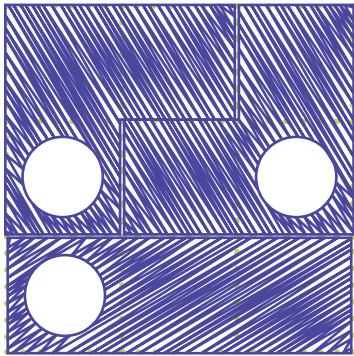
3. **Find and draw two groups of shapes that each add up to an area of 7.**
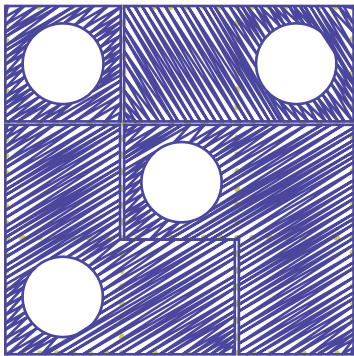
CHIP THEORY Kids
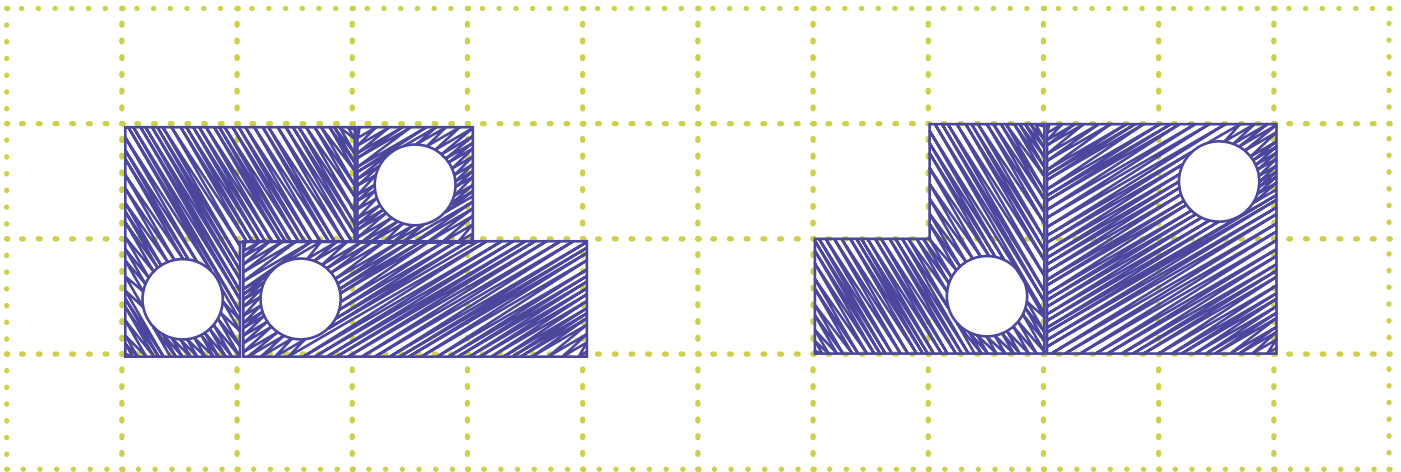
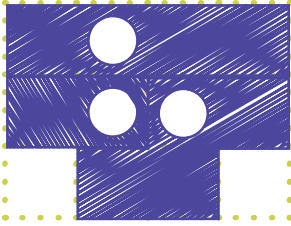4. *Now find and draw four groups of shapes that each add to an area of 8.*

5. *Find three shapes that have a combined total area of 9 and can be arranged in a 3x3 square.*
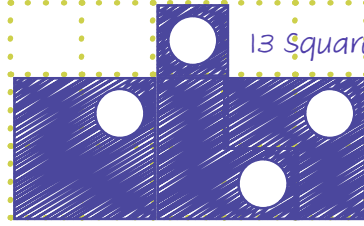

6. *Now find four shapes with a total combined area of 9 that can be arranged in a 3x3 square.*
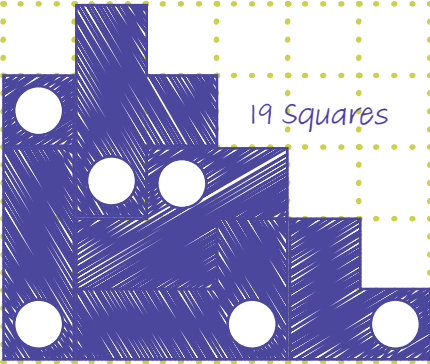
7. Find and label sets of shapes that have areas of: 10 squares, 13 squares, 16 squares, and 19 squares.
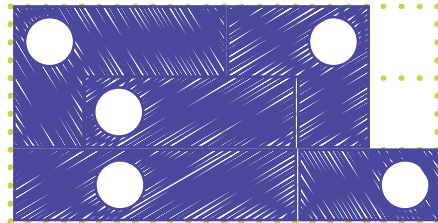
10 Squares

13 Squares

19 Squares

16 Squares

PART 3 - MAKING PUZZLES

In this section, you will make your very own 4x4 mini puzzle, as well as a mega-puzzle using all the shapes from *Neighborhood Hide & Seek*. Follow the steps below.

4x4 Mini Puzzle

1. *Select a set of shapes that have a sum of 15 and arrange them in the 4x4 grid below.*

2. *In the one uncovered space, draw a stick figure or emoji face.*

3. *Trace the circles from each shape onto the grid in the correct location.*

4. *Now sketch the appropriate piece shapes in each of the circles you traced.*

5. *Finally, remove all the pieces from the grid and draw more stick figures or emoji faces in a few additional squares.*

Congratulations! You have made your very own *Neighborhood Hide & Seek* mini puzzle to challenge your friends.

Mega-Puzzle

1. *Using all of the shapes, arrange them to fill the 4x8 grid to the right.*

2. *Remove the small blue square piece. This spot will be the solution for your puzzle.*

3. *Draw a stick figure or emoji face in the uncovered space.*

4. *Trace the circles from each shape onto the grid in the correct location.*

5. *Now sketch the appropriate piece shapes in each of the circles you traced.*

6. *Finally, remove all the pieces from the grid and draw more stick figures or emoji faces in a few additional squares.*

Congratulations! You have made your very own *Neighborhood Hide & Seek* mega-puzzle to challenge your friends.

6th Grade

- 6.RP.A.1: Understand the concept of a ratio and use ratio language to describe a ratio relationship between two quantities.

7th Grade

- 7.G.B.6: Solve real-world and mathematical problems involving area, volume and surface area of two- and three-dimensional objects composed of triangles, quadrilaterals, polygons, cubes, and right prisms.

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