## Pent-up Pentominoes

Summary
Students will explore pentominoes in this activity.

Main Core Tie
Mathematics Grade 3
Strand: MEASUREMENT AND DATA (3.MD) Standard 3.MD. 8

## Additional Core Ties

Mathematics Grade 3
Strand: MEASUREMENT AND DATA (3.MD) Standard 3.MD. 5
Mathematics Grade 3
Strand: MEASUREMENT AND DATA (3.MD) Standard 3.MD. 6
Mathematics Grade 3
Strand: MEASUREMENT AND DATA (3.MD) Standard 3.MD. 7

Materials
One inch tiles
Pentomino sets

- Pentominoes grid sheets
- Pentominoes grid

Various sized grid cards
Crayons
Overhead Pentominoes grid
Overhead Pentominoes
Blank chart for pentomino shapes
A set of paper pentomino shapes
Overhead color tiles
Overhead markers
One domino
Additional Resources
Books

- Chasing Vermeer , by Blue Balliett; ISBN 0-439-79927-9
- Problem Solving with Pentominoes
, ISBN 1-569-11999-6


## Background for Teachers

[^0]Intended Learning Outcomes
5. Understand and use basic concepts and skills.

Instructional Procedures
Invitation to Learn
Who can tell me what this is? (Hold up a domino.) Domino is a familiar word. Write it on the board. The definition of a domino is two squares that share one whole side. Write omino above the word domino. It only has one square. Write triomino below domino. It has three squares that share complete sides. Discuss other words that have the tri- prefix. On an overhead grid, place one inch overhead-color tiles to show two ways to represent triominoes:
Then talk about tetrominoes the same way:
Discuss non-examples or shapes that are flipped:
How many squares would we have in a pentomino? Write the word under tetrominoes.
Instructional Procedures:
Our lesson is about pentominoes. Pentomino pieces are made up of five squares that share at least one full side. The students are to place five one inch color tiles on the Pentominoes grid sheet to make a pentomino shape. (They need two sheets.)
The teacher will walk around and choose a student to come to the overhead and build the shape that they made at their desk. Everyone will stop and get a red crayon and record the shape from the overhead onto the top left corner of their sheet. Tell the class the letter name for that piece. Put that pentomino shape on a chart labeled with its letter name. Add others to complete the chart as your students discover the other pentomino shapes. The teacher will then watch for another student to complete a different pentomino, and invite him/her to come to the overhead to show the whole class. This time, everyone needs to use a different colored crayon to record the pentomino in the bottom left corner. Try it first with the tiles to see if the piece will fit before it's colored.
Continue this process until six pieces have been recorded on one sheet with six different colors. Then use the second sheet for recording the other six pieces. Tell the students the letter name of each piece as it is discovered. Don't tell the students that there are 12 different pentomino shapes. Let them discover that fact on their own.

## Extensions

Curriculum Extensions/Adaptations/ Integration
For another day's lesson, pass out the Pentominoes grid cards with a 6"x10" rectangle. Ask the students to follow your directions to make a rectangle with the pieces that you hold up. (Refer to the solution on the next page.) They hold up the pieces, too. Use positional words as you describe where the pieces go. Then mess it up and do the rectangle a different way. Pass out different sized rectangle grids: 3"x 5", 5"x 5", 5"x 7", 5"x 12", 4"x 15". Let them know that you don't always need to use all of the 12 pieces in the smaller rectangles. Allow the students to explore how to make rectangles of different sizes. If a student would like to share her solution, he/she may come to the overhead to describe how to build it, using positional words.
Play a pentomino game called Last Piece with a partner on the 6"x10" Pentominoes grid card. Each player takes a turn placing a pentomino shape on the grid from her own set. There may be squares that are trapped or not covered. The person to put the last piece on the card is the winner. Pair students of equal problem solving ability if possible.
Make a 1-100 chart puzzle. Start cutting a cardstock 1-100 chart, using five squares (or a pentomino shape) for each puzzle piece. As you near the last sections predict how you can still cut those pieces into pentomino shapes. Put the puzzle together by looking at patterns of tens and ones.
Allow accelerated students to make their own puzzle cards with a pentomino picture on one side
of the card and the solution glued to the back of the card. These could be used for center activities.
Using the pentomino letter names, see how many words you can make. (Two-letter words: it, if, in. Three letter words: lit, pit, put, etc.)
Family Connections
Send home a Pentominoes grid paper and a set of paper pentominoes with each student for homework. Also send a small version of a 12 piece rectangle for the $6 " \times 10 "$ grid. Tell the students to show their parents how to build that rectangle. Then explore other rectangles. There are thousands of solutions!
Send home the Chasing Vermeer web site for a fun pentomino game.
Play the pentomino game, Last Piece with your family.
Using the paper pentomino shapes with their letter names, make as many words as you can.

## Assessment Plan

When all twelve shapes are recorded, pass out the sets of pentominoes. Ask each student to hold up the W piece. Then find where it is recorded on one of their sheets and place it on top of the shape that they have colored. Do a few more pieces as a whole class, and then let them continue to place their pieces on top of their colored shapes, until all of them are covered. Leave them there until you come around to check their papers. Make a mistake on the overhead (like coloring six squares instead of five). Model how to fix it by crossing out a mistake with a black X. Ask the students to hold up the correct shape when you call out its letter name.
Put the pentomino puzzles in a center for independent work. Check their progress.

## Bibliography

Studies show that explicitly engaging students in the creation of nonlinguistic representations stimulates and increases activity in the brain.
Gerlic, I., Jausovec, N.. (1994). Multimedia: differences in cognitive processes observed with EEG. Educational Technology Research and Development, Volume 47 (Issue 3), Pages 5-14.
Geometry games give practice with properties that children have learned so far and strengthen children's use of descriptive language as a tool for reasoning about shapes and their properties. They also give teachers a window to children's developing levels of thinking.
van Hiele, Pierre M., (1999). Developing geometric thinking through activities that begin with play. Teaching Children Mathematics, Feb. 1999, Pages 310-316.

## Authors

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[^0]:    A pentomino is an arrangement of five congruent squares placed edge-to-edge. Some pentomino shapes look different when turned or flipped. When a student discovers the $P$ shape, it is good to stop and discuss the eight different ways to look at that piece. Point out that we consider all versions of the $P$ shape, to be the same. That is, if the $P$ shape is turned or flipped to make it appear different it is still called the P shape.
    This activity is appropriate to do in late fall or winter.

