

Polyomino Exploration

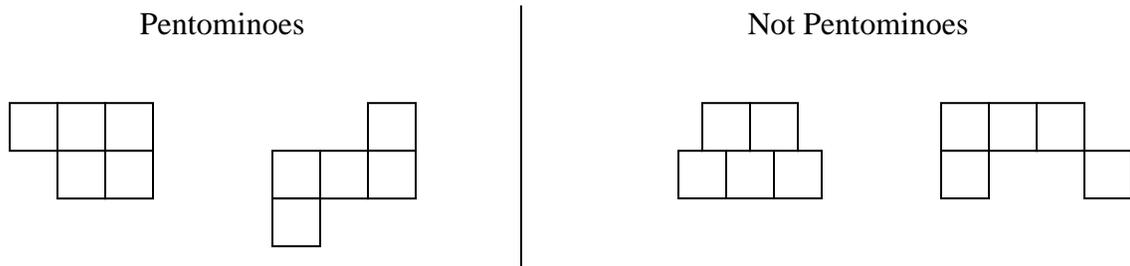
Polyominoes are geometric figures that are composed entirely of squares. Some examples of different types of polyominoes are:

- **Dominoes**: made from two squares
- **Tetrominoes**: made with four squares and used in the game Tetris[®]

The word polyomino was coined by Solomon Golomb, an American mathematician, in 1953, though puzzles with different kinds of polyominoes seem to have been around for centuries. Today we will be learning about the type of polyomino called a **pentomino**.

Part 1 – Defining Pentominoes

Below is a picture of two figures that are pentominoes and two that are not pentominoes.

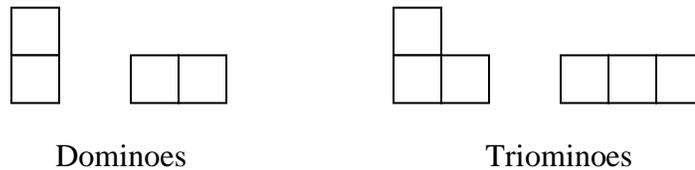


1. Write your definition of a **pentomino**.

2. Write your second draft of your definition of a **pentomino**.

Part 2 – How Many Polyominoes?

All **dominoes** have the same shape. If you look at the two **dominoes** below at the left, you can see that the second domino is the same shape as the first; it has simply been rotated 90 degrees. When we get to **triominoes**, made with three squares, the matter is still rather simple. There are two different **triominoes**, as shown in the figure below at the right.



When we get to **tetrominoes**, made with four squares, there are a few more.

1. Determine how many different **tetrominoes** there are. Show your solutions by cutting out your different **tetrominoes** (Hint: Make use of Transformation Geometry to be sure you have unique solutions. Reflections and rotations do not give new solutions).

When we search for all **tetrominoes**, a more or less random trial-and-error strategy is often sufficient. However, when we move to **pentominoes**, the number of possibilities is great enough so that it pays to be more systematic and less random.

1. How many “different” **pentominoes** can be made? Show your solutions by cutting out your different pentominoes. Describe any strategies other than random trial and error that you used in your search.
2. Once you think you have found all of the pentominoes, explain why you think you have them all.

3. As a class, come up with a name for each different pentomino. This is necessary to make communication easier.

Part 3 – A Pentomino Game

Materials: Your set of pentominoes
A game board designed like an 8 x 8 chessboard (8 x 8).

Directions:

1. Players take turns placing one pentomino on the board. The pieces must not overlap or extend beyond the boundaries of the board, but they do not have to be adjacent.
2. The winner is the last person who can place a pentomino on the board so that it does not extend beyond the board and does not lie on top of a previously played pentomino.

Play the game several times. Describe any strategies you discovered.

Part 4 – Investigating the Properties of the Pieces

Piece Name	Area	Perimeter	# of Sides	Symmetries

Arrange all of the pentominoes into a large rectangle:

1. What are the dimensions of the rectangle?
2. Is there another solution?
3. Can they form a square?