

# Mathematical investigation (1)

*Investigating is a great way to learn to think mathematically, apply logic, spot patterns and improve our perseverance.*

## Polyominoes

**AIM:** To systematically find different ways of arranging squares.

**You will need:**

2 sheets of squared paper, pencil.

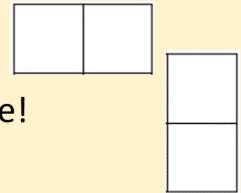
**What is a polyomino?**

A **polyomino** is made by joining 2 or more equal squares, whole side to side.

The simplest polyomino is a **domino**.

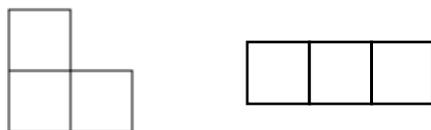
There is only ONE way to join two squares together side to side!

You can **rotate** the **domino** but it is still the same **domino**!

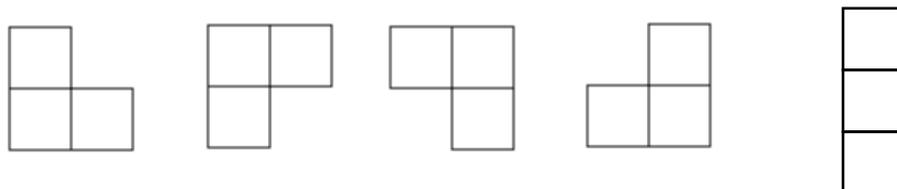


A **third square** can be added to make a **triomino**.

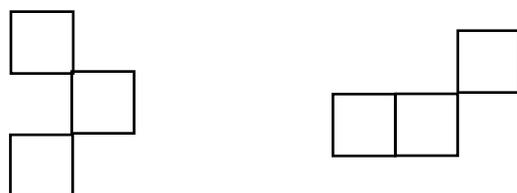
There are 2 **unique** ways to do this:



There are several **rotations** and **reflections** of the two **unique** shapes!

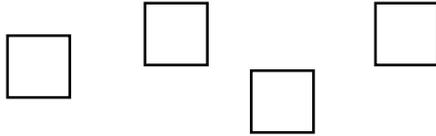


These two are **NOT triominoes** can you explain why?



*Let's find some tetrominoes...!*

**What to do:**



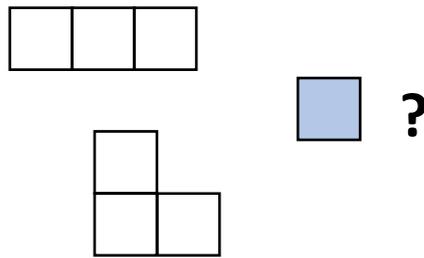
**Four squares** joined side to side make a **tetromino**.

How many **unique** arrangements can you find?

Use the squared paper to sketch them.

### Getting started

A good way to find **tetrominoes** is to draw one of the two **triominoes**, then add a fourth square.

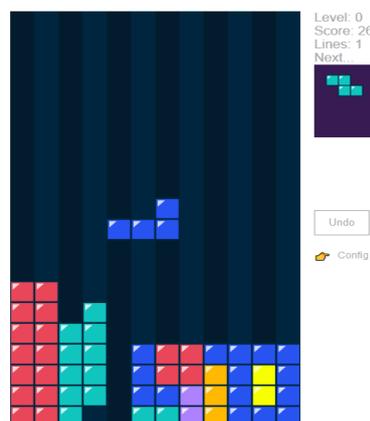


Remember the squares have to be joined side to side.

When you think you have found them all, double-check that none are rotations or reflections.

Then check the answers page. Did you find them all?

**Tetris** is a mathematical puzzle game which uses the tetromino shapes. You can try it at this website: <https://www.mathsisfun.com/games/tetris.html>



***Now let's find some pentominoes...!***

## 'Penta place'

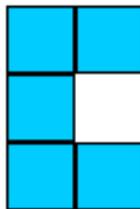
The **Pentigles** always build their houses from five square rooms on ground level.

The houses can be designed in a variety of shapes, but a room must be joined to at least one other room by one whole wall.

Here is a design drawing for a **Penta** house, a view from above.



Here is another one:



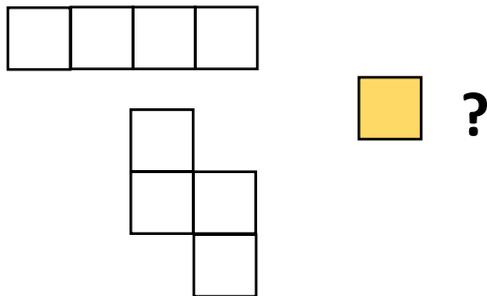
There are many different ways that you can arrange the five rooms.

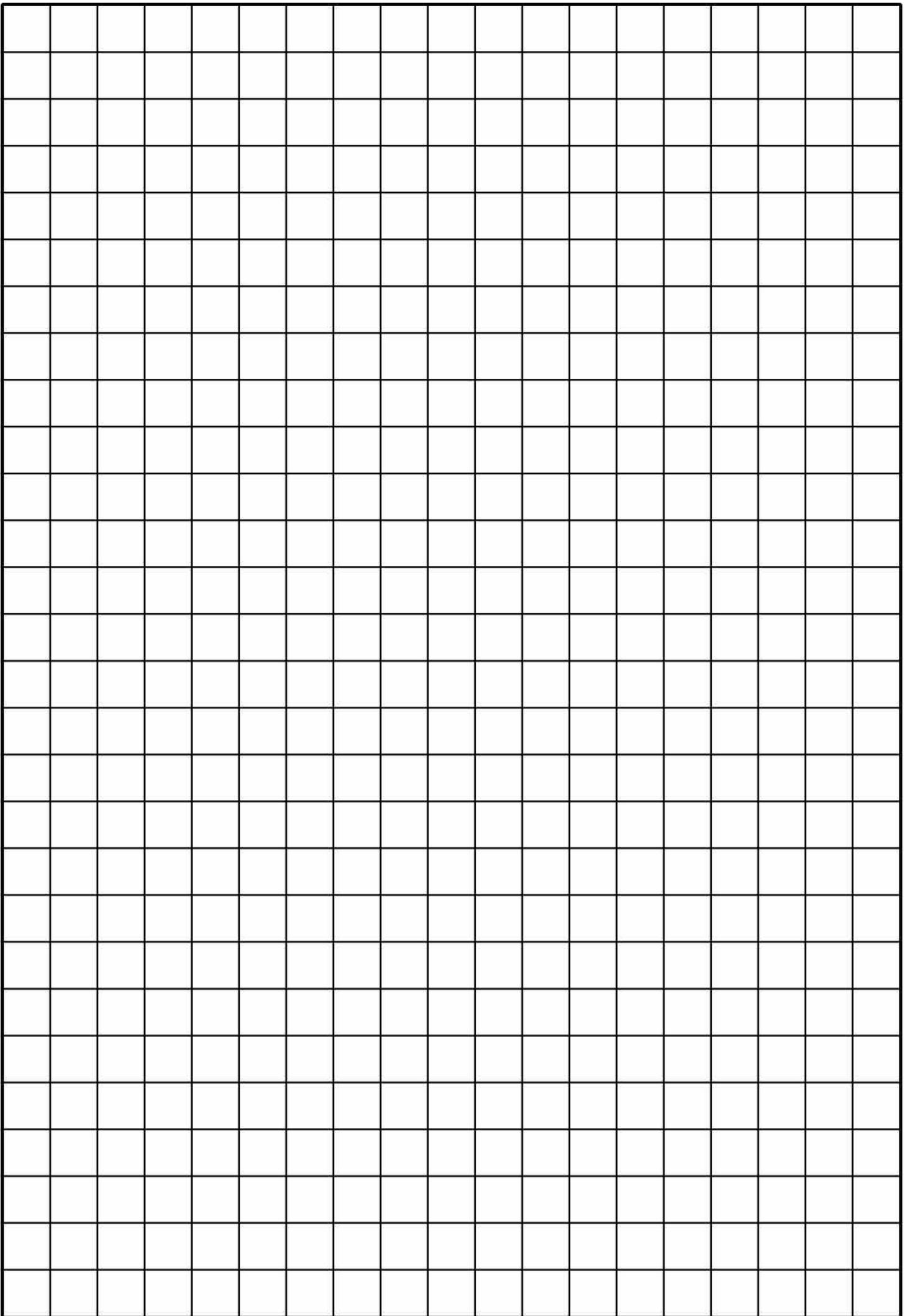
I wonder how many different **Penta** homes you can create?

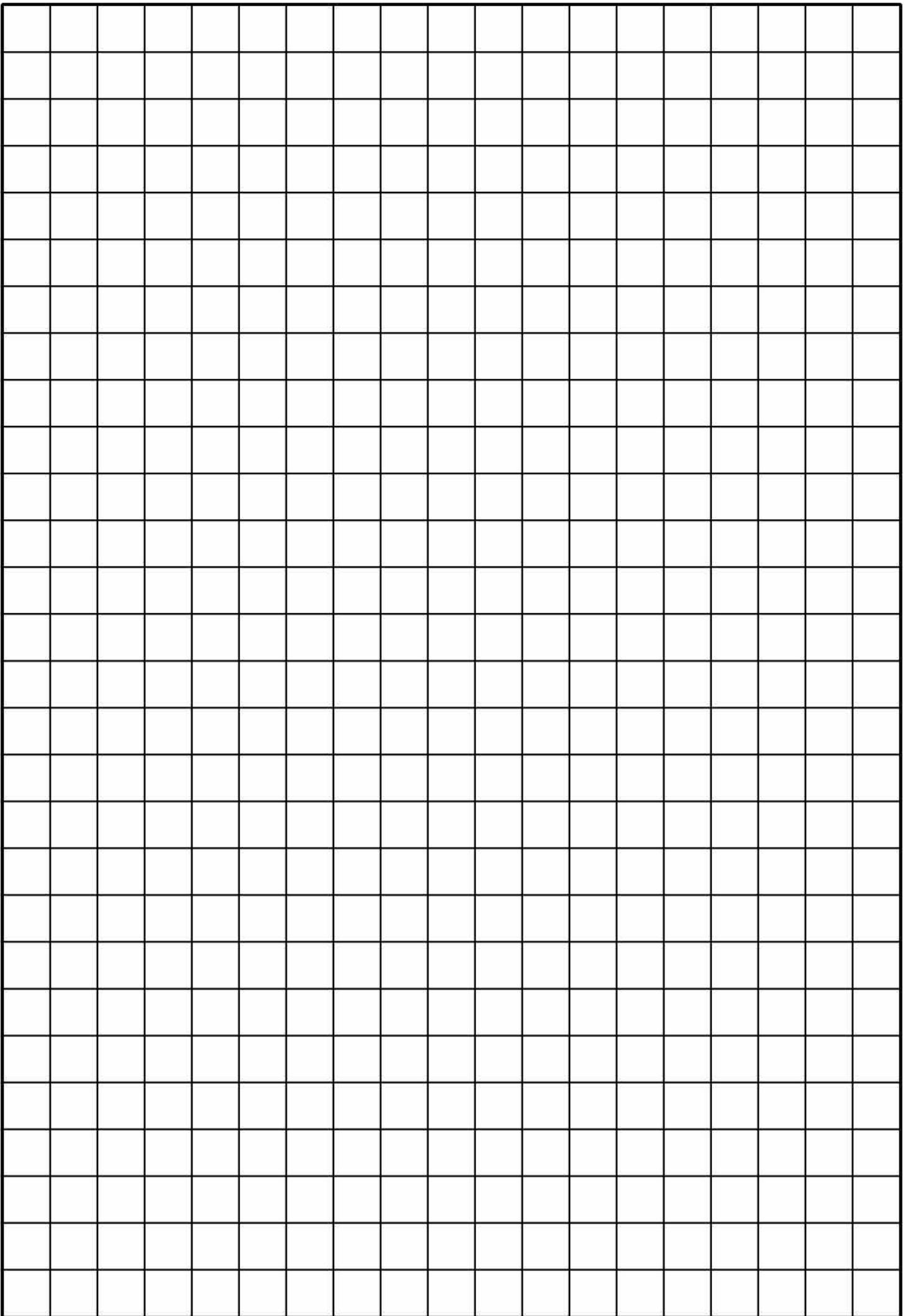
Try to find all possible shapes the **Pentigles** can build their homes...

## Hint!

A good way to help the **Pentigles** is to start with one of the **tetrominoes** and then add then add a fifth square.

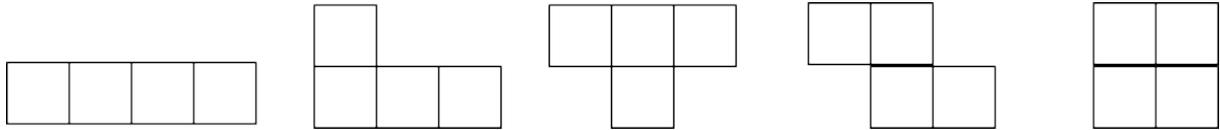




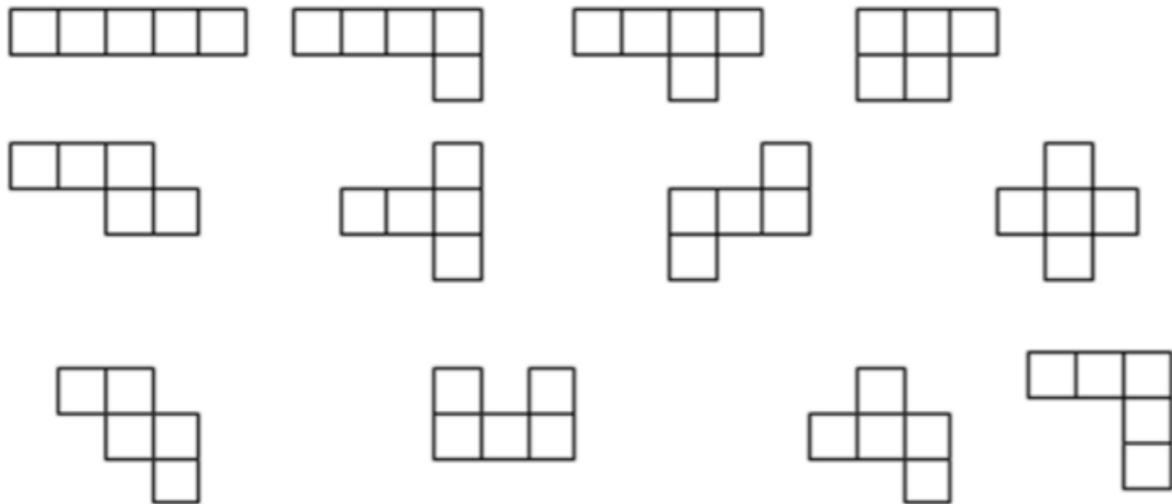


## Answers

There are 5 unique **tetrominoes**.



There are 12 unique **pentominoes**.



If you can't see one of your solutions check to see if it is a rotation or reflection of one of these. If in doubt you can always cut out your shape and rotate or reflect it to see whether it matches one of the solutions!