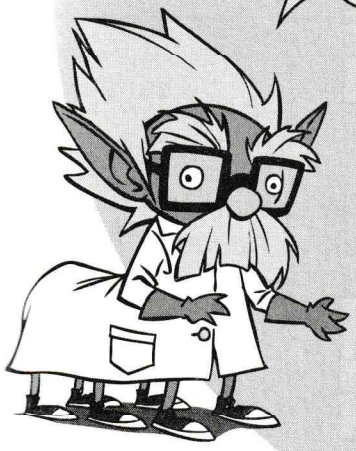
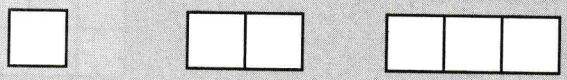


A domino is just one type of ***polyomino.***

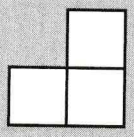
A polyomino is a shape made by joining the sides of squares that are the same size. One square is called a ***monomino.***

Two squares make a ***domino.***

Three squares make a ***triomino.*** There are two triominoes.

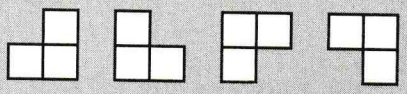


Straight triomino.



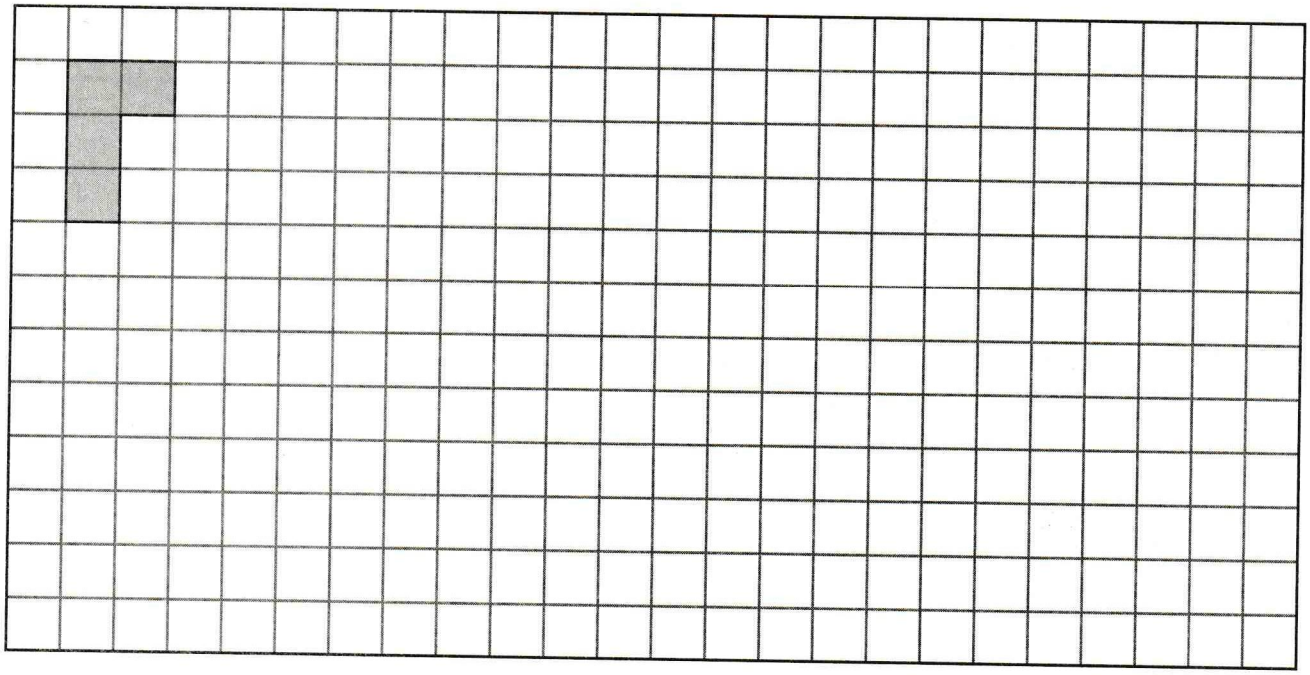
L-triomino.

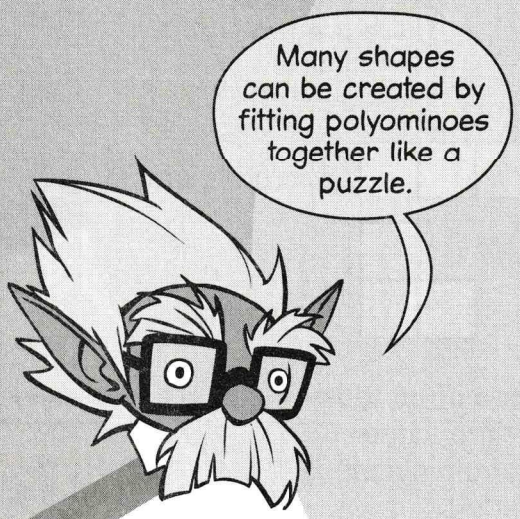
If two polyominoes can be flipped or turned to look the same, they count as the same polyomino. For example, all four triominoes below count as the same L-triomino.



PRACTICE

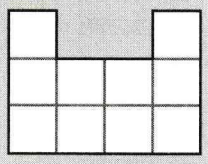
69. Four squares make a tetromino. There are a total of five different tetrominoes. One has been traced for you on the grid below. Trace the other four tetrominoes.
Remember that if you can flip or turn one to look like another, they count as the same tetromino.



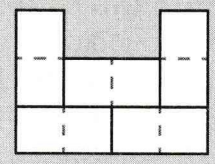


EXAMPLE

How can five dominoes be arranged to create the shape below?



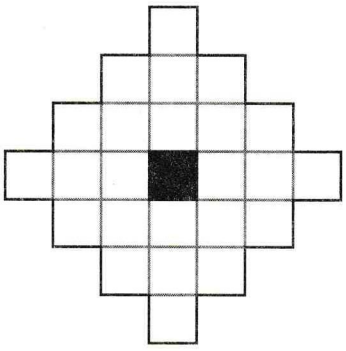
There is only one way to arrange five dominoes to make the shape:



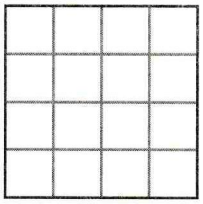
You can cut out the polyominoes on the facing page to use for the puzzles in this section, or print a page of polyominoes to cut out at BeastAcademy.com.

PRACTICE

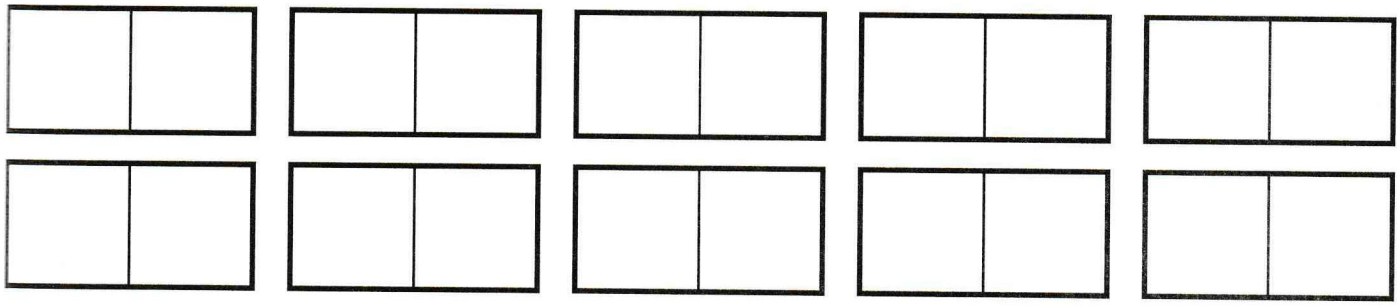
70. Arrange eight L-triominoes to create this shape with a hole in the middle.



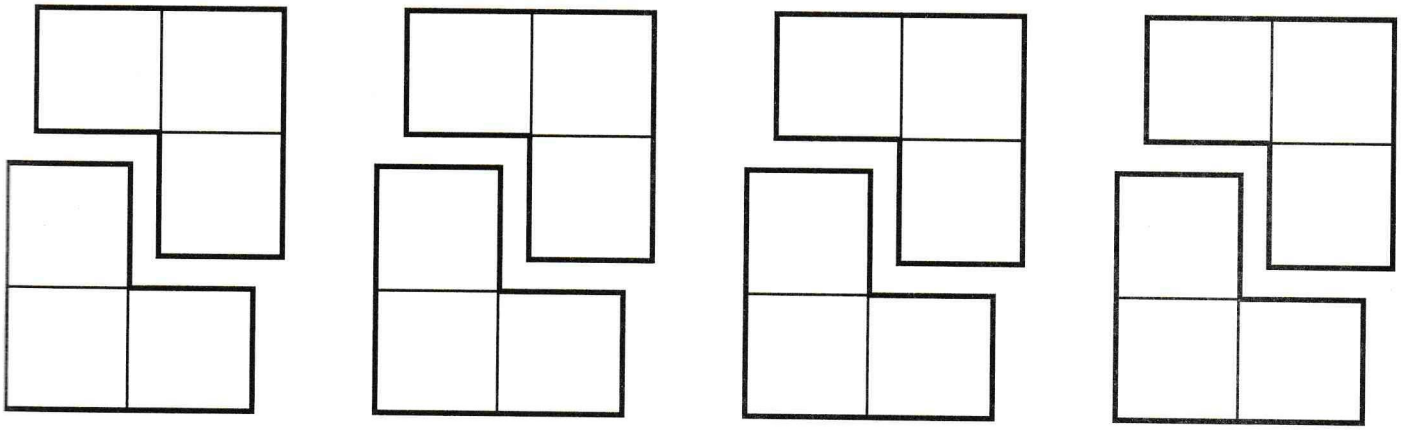
71. Arrange one monomino, one L-triomino, and four straight triominoes to make a square.



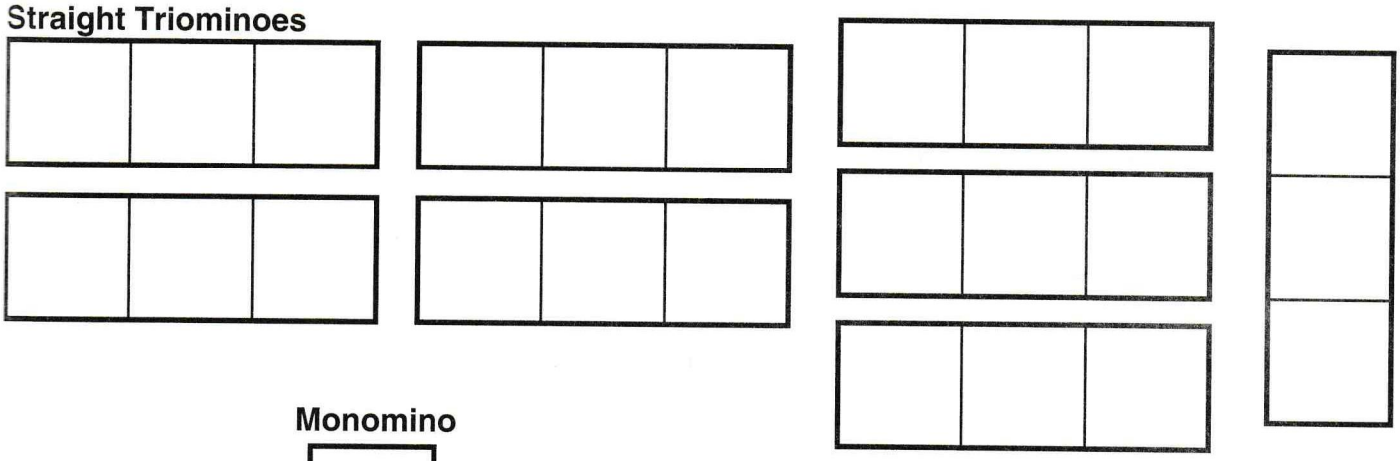
Dominoes



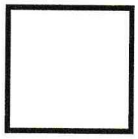
L-Trominoes



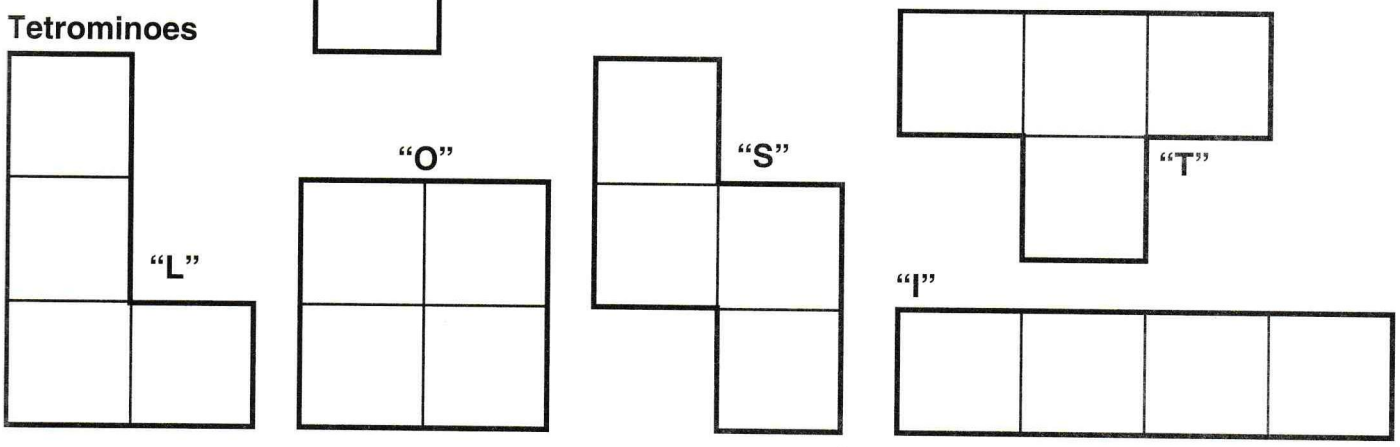
Straight Triominoes



Monomino



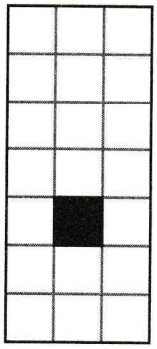
Tetrominoes



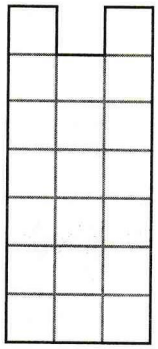
PRACTICE

Arrange the five tetrominoes (one of each) to create each of the shapes below. Problems 72–75 are from the Lab section beginning on page 34 of the Guide.

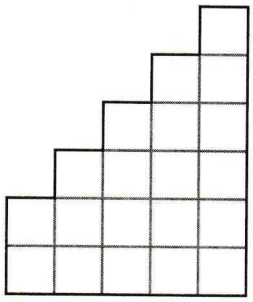
72. ★



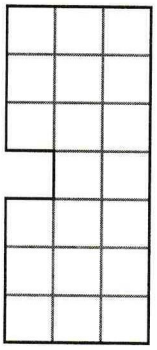
73. ★



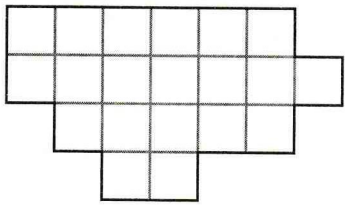
74. ★



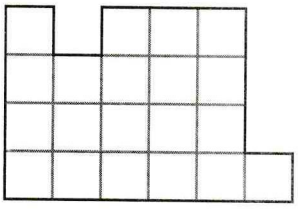
75. ★

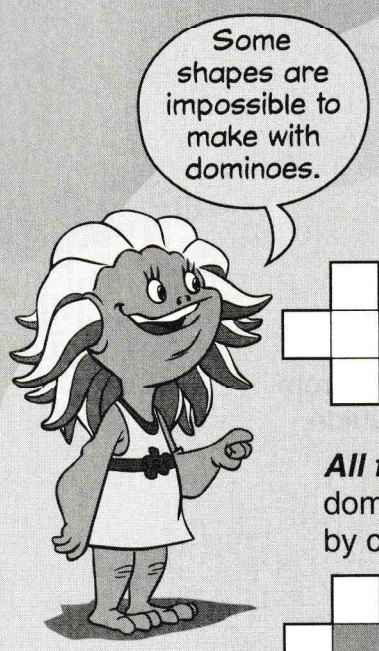


76. ★



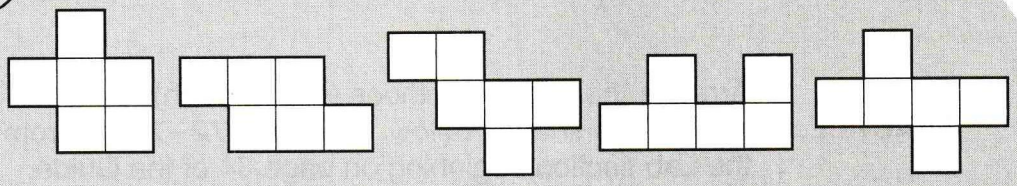
77. ★



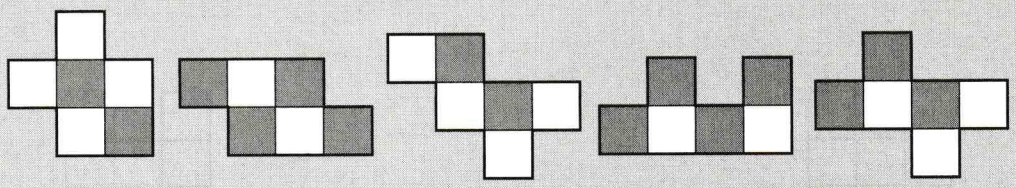


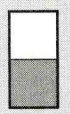
EXAMPLE

A hexomino is made by joining six squares. How many of the hexominoes below are ***impossible*** to make with three dominoes?



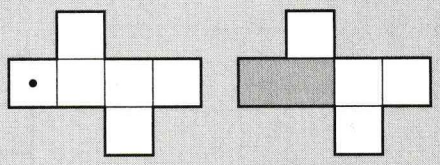
All five hexominoes above are impossible to make with three dominoes. We can show that the first four shapes are impossible by coloring each with light and dark squares like a chess board:





If we place a domino on a chess board, it will always cover one light square and one dark square. So, three dominoes will cover three dark and three light squares. The first four hexominoes above all have a different number of light and dark squares, so the first four shapes cannot be made with dominoes.

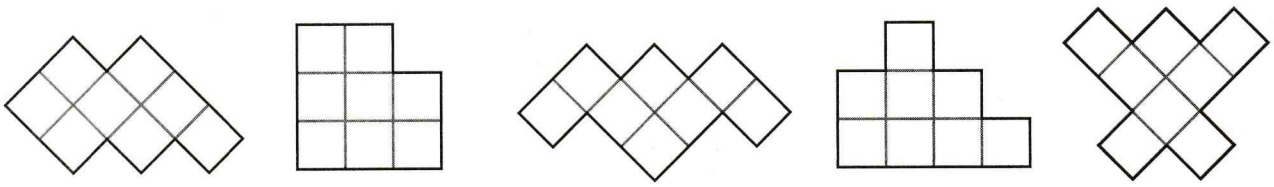
The last shape has three light squares and three dark squares, but is still impossible to make with dominoes. Why? Try covering the shape with dominoes. There is only one way to place a domino that covers the square marked with a dot below.



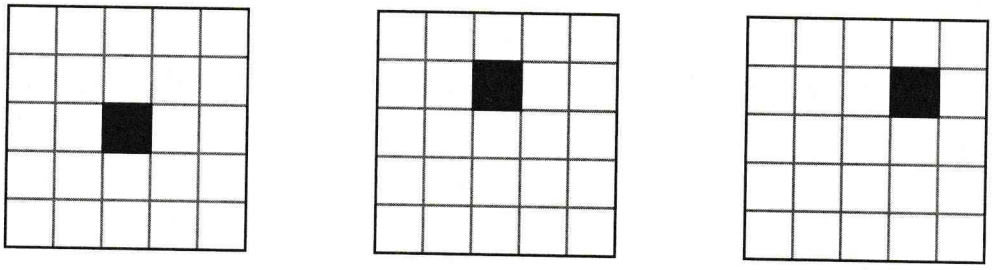
The four remaining squares cannot be covered with dominoes.

PRACTICE

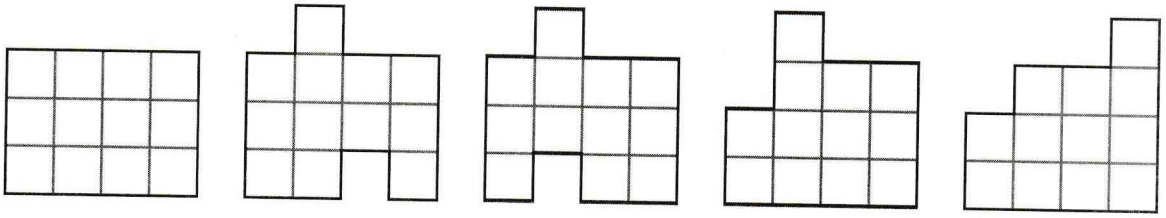
78. An octomino is made by joining eight squares. Circle the three octominoes below that are ***impossible*** to make with dominoes.



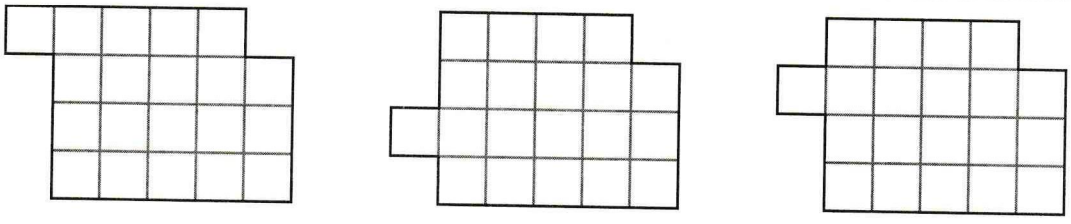
79. Each square below has a hole in it. Circle the shape that is ***impossible*** to make with 12 dominoes.



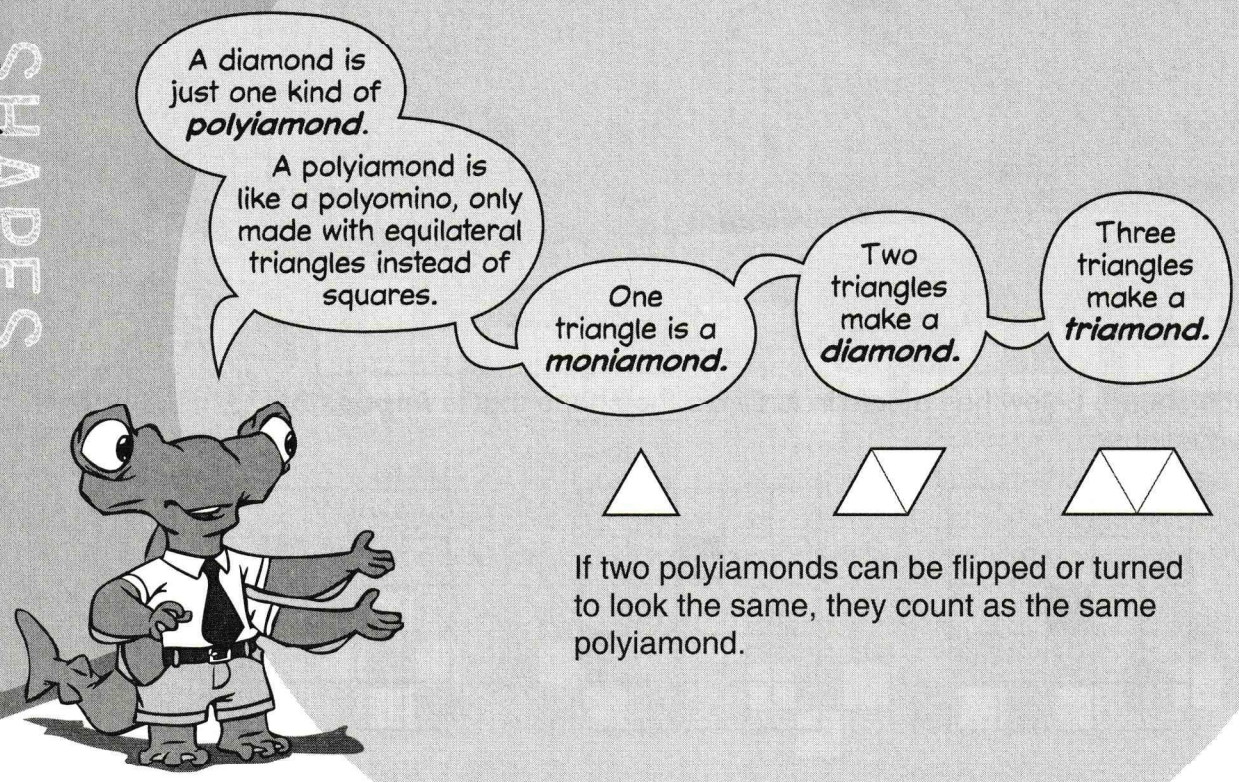
80. ★ Circle the only shape below that ***can be made*** with one T-tetromino () and four dominoes.



81. ★★ Circle the shape below that is ***impossible*** to make with the five tetrominoes (one of each):



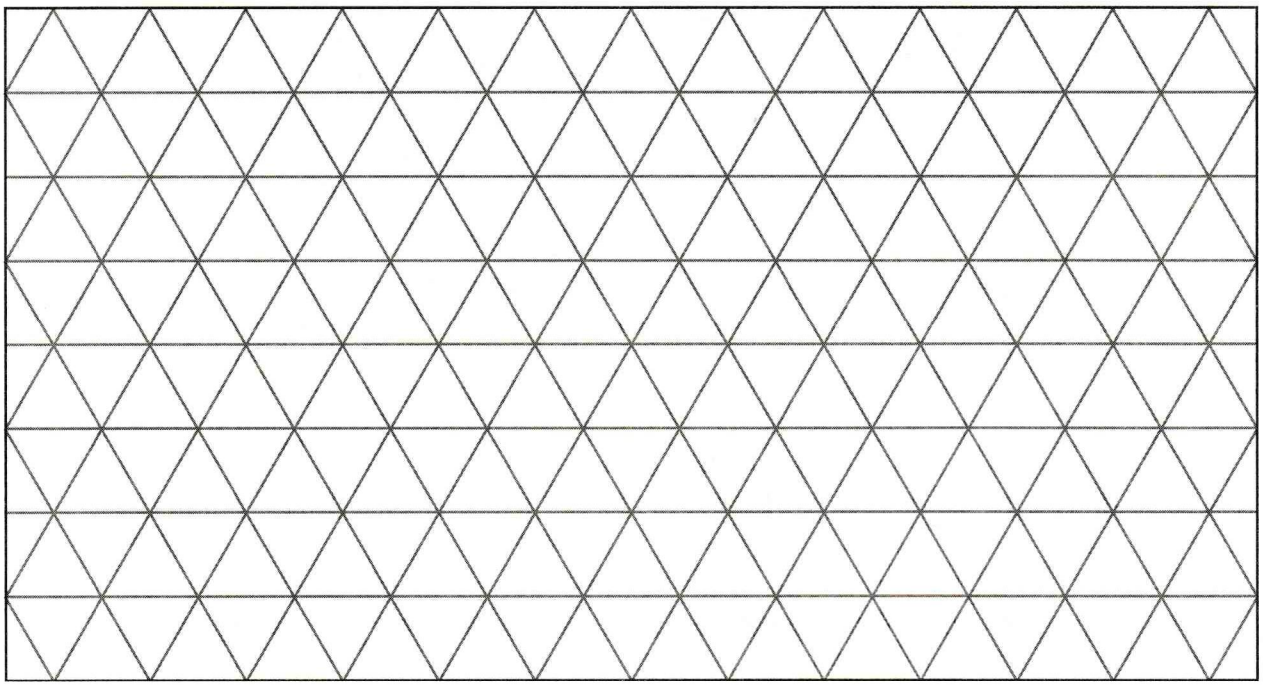
Challenge: Make the two shapes that are possible with the five tetrominoes.



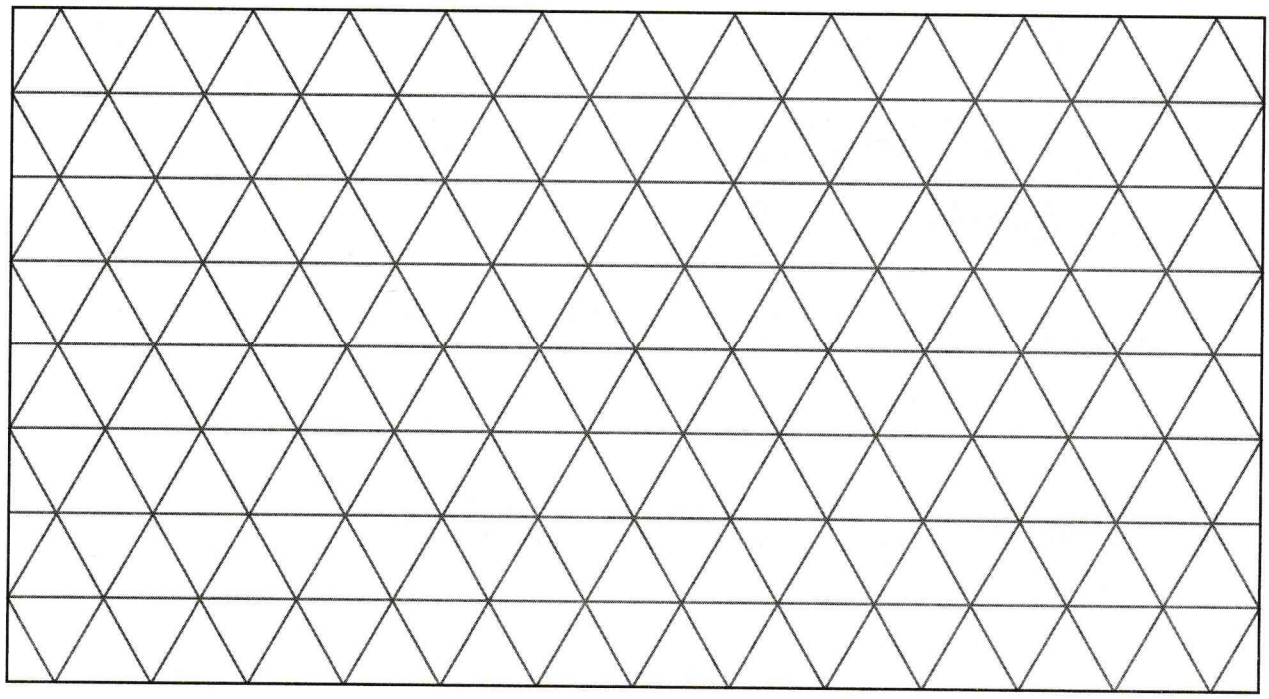
If two polyiamonds can be flipped or turned to look the same, they count as the same polyiamond.

PRACTICE

82. There are a total of three different polyiamonds that can be made from four equilateral triangles. They are called tetriamonds. Trace the three tetriamonds on the grid below.



83. There are a total of four different polyiamonds that can be made from five equilateral triangles. They are called pentiamonds. Trace the four pentiamonds on the grid below.
Remember that if you can flip or turn one to look like another, they count as the same pentiamond.



84. Look at the outlines of the three tetriamonds you drew on the previous page.
How many of these are:

Triangles? _____

Quadrilaterals? _____

Pentagons? _____

Hexagons? _____

85. Look at the four pentiamonds you drew above.
How many of these are:

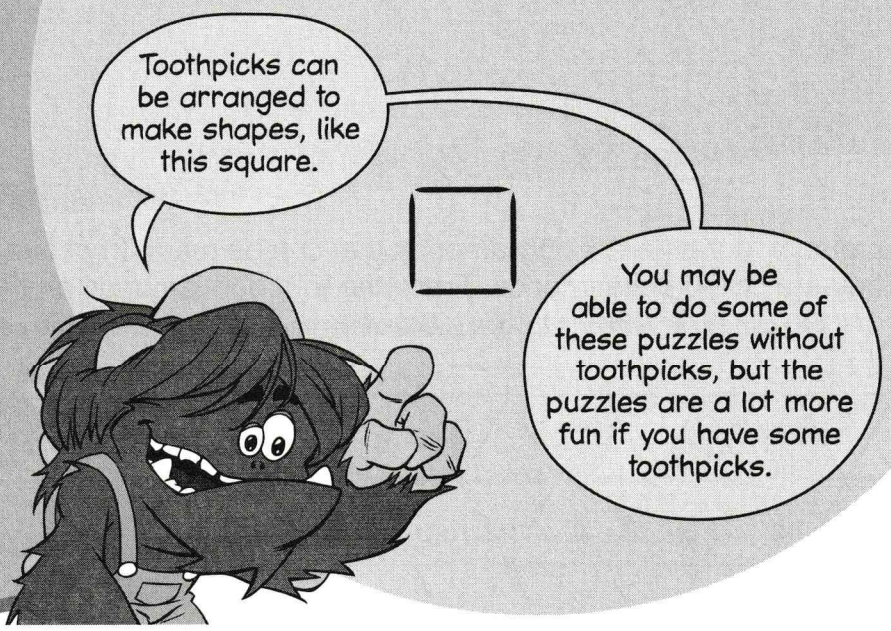
Triangles? _____

Quadrilaterals? _____

Pentagons? _____

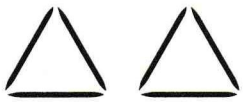
Hexagons? _____

Heptagons? _____



PRACTICE Solve each of the toothpick arrangement puzzles below. Draw your final arrangement in the space below each puzzle.

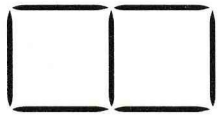
86. Six toothpicks can be arranged as shown to make two triangles. How can only five toothpicks be arranged to make two triangles?



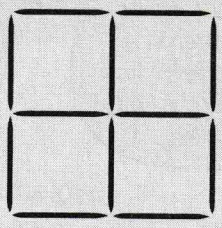
87. Nine toothpicks can be arranged as shown to make four triangles. How can nine toothpicks be arranged to make five triangles? (The triangles do not all need to be the same size.)

88. Ten toothpicks can be arranged as shown to make three rhombuses. How can only nine toothpicks be arranged to make three rhombuses?

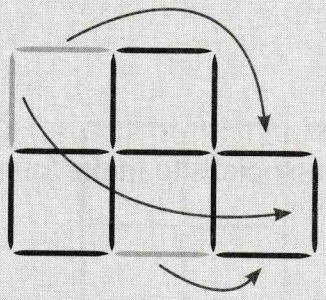
89. ★ Seven toothpicks can be arranged to make two squares. How can six toothpicks be arranged to make five squares? (The squares do not all need to be the same size.)



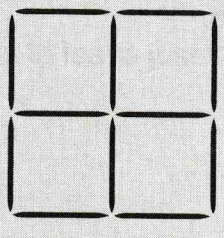
EXAMPLE | Move three toothpicks in the arrangement below to leave three squares.

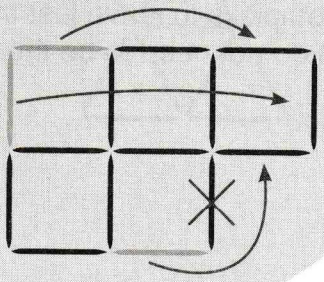


One solution is shown. The new arrangement has three squares.



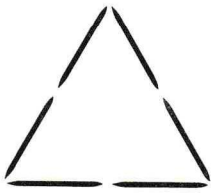
For all of the toothpick puzzles, every toothpick should be part of a shape in the new arrangement. For example, the attempt below leaves three squares, but the toothpick marked with an X is not part of a square, so this is not a correct solution.



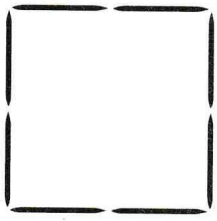


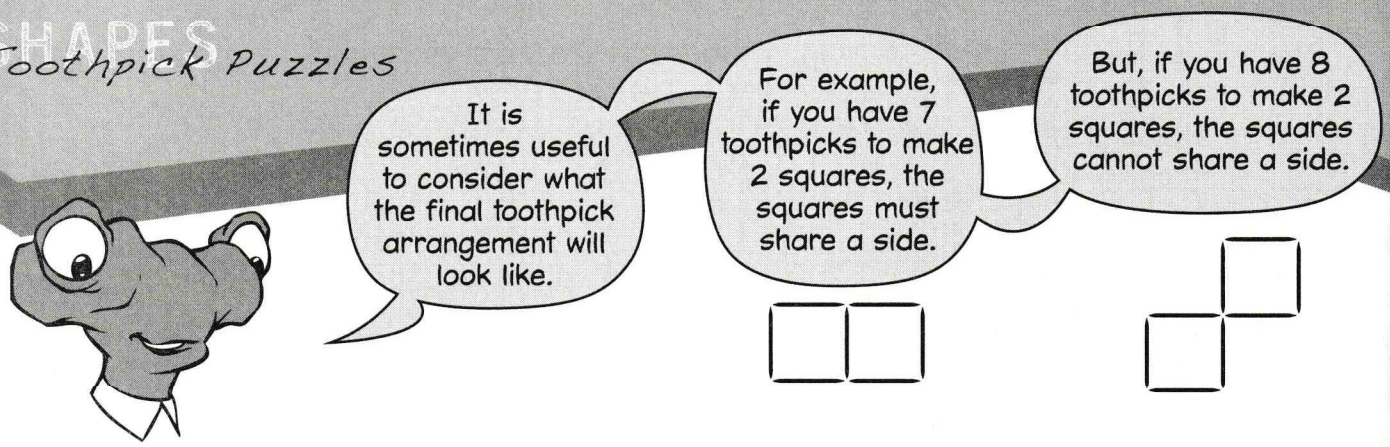
PRACTICE | Begin each toothpick puzzle below with the given arrangement.

90. Move two toothpicks to make two equilateral triangles.

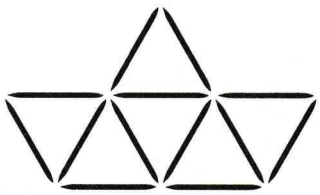


91. Move four toothpicks to make two squares.

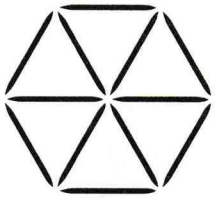




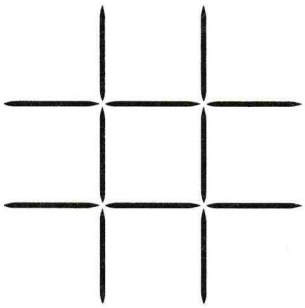
92. ★ Move three toothpicks to make four non-overlapping rhombuses.



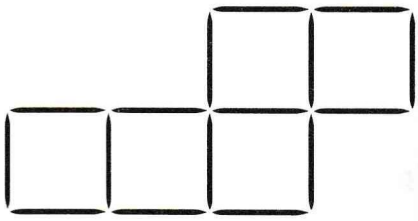
93. ★ Move four toothpicks to leave just three equilateral triangles. The triangles do not need to be the same size.



94. ★ Move four toothpicks to make three squares with no toothpicks left over.

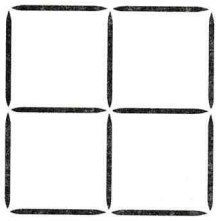


95. ★ Move two toothpicks to make four squares that are the same size with no toothpicks left over.

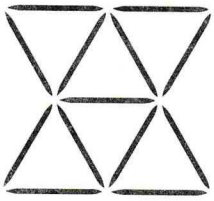


PRACTICE | For the toothpick puzzles below, you are ***removing*** toothpicks.

96. There are five squares in the arrangement shown (four small and one large). Remove two toothpicks to leave just two squares.



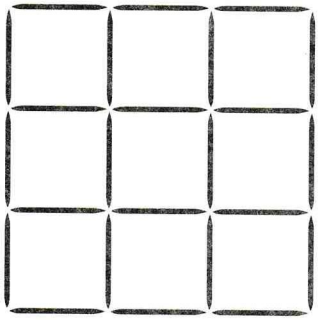
97. How many equilateral triangles are there in this arrangement?



97. _____

98. Remove three toothpicks to leave just three equilateral triangles.

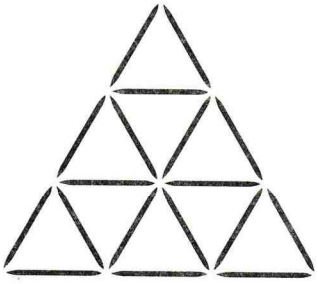
99. How many squares are there in this arrangement?



99. _____

100. Remove four toothpicks to leave just five squares.

101. How many equilateral triangles are there in this arrangement?



101. _____

102. ★★ What is the smallest number of toothpicks that must be removed so that no triangles of any size are left in the diagram?

102. _____