

TEACHER SHEET



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 KATAMINO
SPACE GEOMETRY

LEARN THROUGH PLAY

TOPIC: space geometry

• Objectives:

- Learn basic properties of flat and 3d figures.
- Introduction to space geometry.
- Learn logical reasoning.

• School Level : 4-10 years.

The main objectives of this activity are to learn space geometry and logic.

The teaching sheet proposes several intermediate exercises to get pupils accustomed to the vocabulary of the game, establish a link between 2d and 3d figures, use their imagination, learn logical reasoning and solve basic geometrics issues.

Objectives of the exercises:

- **Exercise 1** ⇒ familiarise pupils with pentaminos.
- **Exercise 2** ⇒ Solve basic geometric issue.
- **Exercise 3, 4 & 5** ⇒ Switch from a 2d plan to a 3d plan.

Once these exercises are complete, pupils will be able to play a game in its simplified version and will have achieved the following:

- **Knowledge objective:** understand a rule.
- **Know-how objective:** observation and concentration; perseverance; imagination; logic.
- **Behaviour objective:** respect for the opponent and the rules, communication.

- The pupil sheet can be kept by pupils. It outlines the game rules with a vocabulary adapted to them, as well as a word list to be kept in mind. (These words can be explained in class).

Intermediate exercises

Exercise 1: define and build pentaminos.

⇒ Get used to « pentaminos ».

First let's define what is a Pentomino. Teachers can use a well-known word to help pupils to understand by themselves: Domino. Helped by their teacher they should understand that the pieces of the game are made of two contiguous squares, which is the meaning of «Domino». Then the teacher can go on and ask them what they think are the meanings of «Triomino», «Tetromino» and finally «Pentamino»: piece made of 5 contiguous squares.

Then pupils can imagine and reproduce all the possible pentaminos on a grid cardstock. They can work in group and talk about the different possibilities. Teachers can explain that there are 12 possibilities to be found (see annexe). They can colour and cut the pieces and then manipulate them to enable better visualisation (rotations, symmetry).

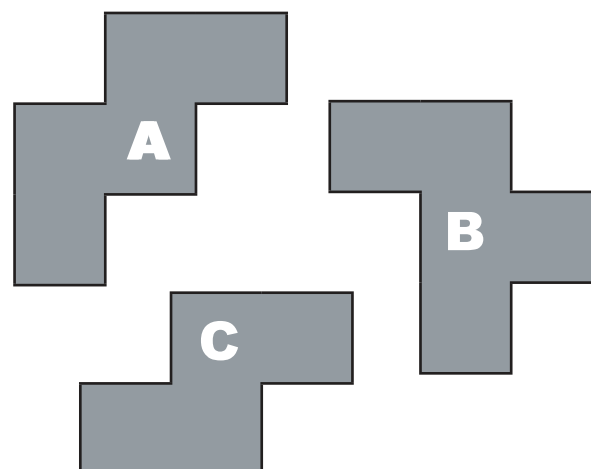
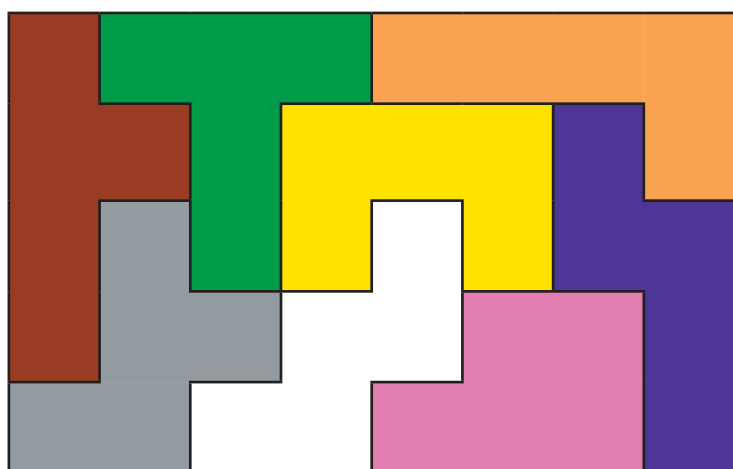
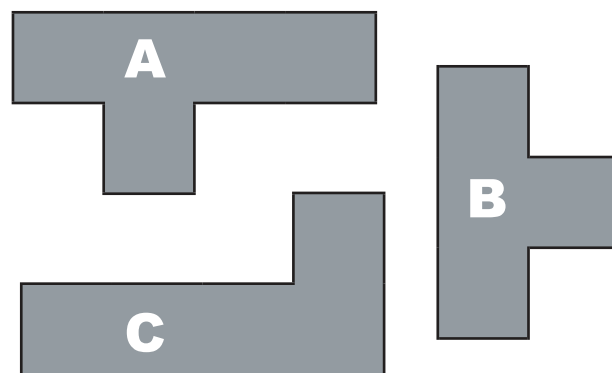
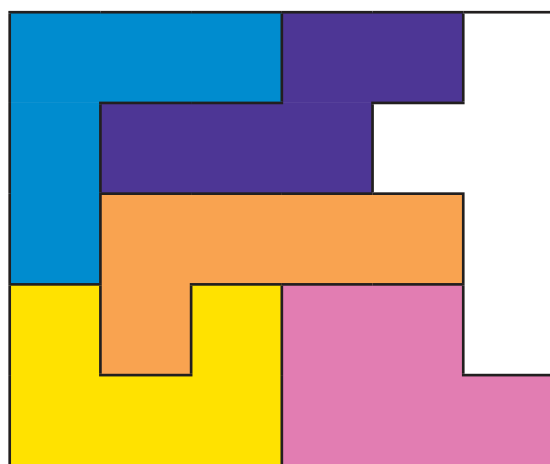
Note : for younger children, the teacher can show the 12 models in order to help pupils to reproduce them on grid cardstock.

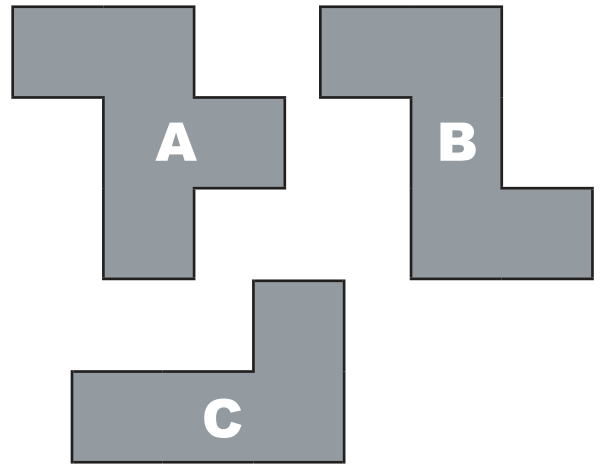
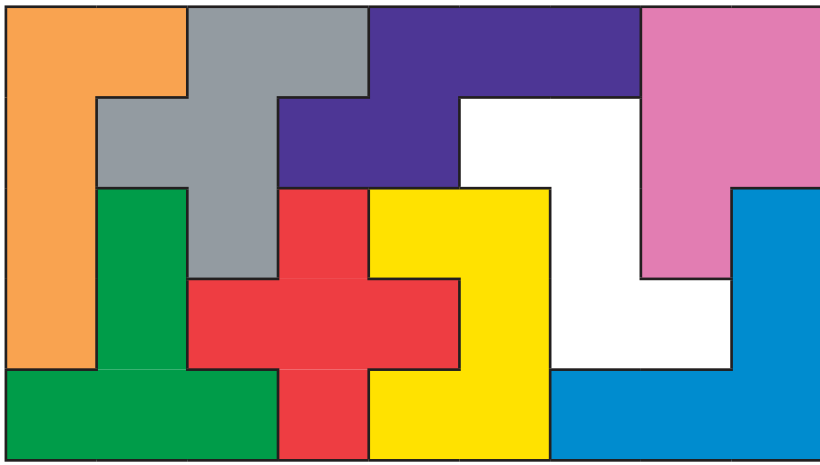
Exercise 2 : Puzzles hole.

⇒ Solve a basic geometric problem

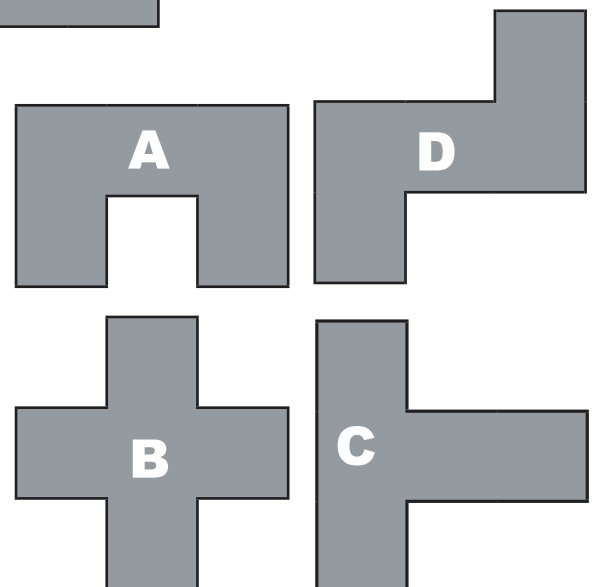
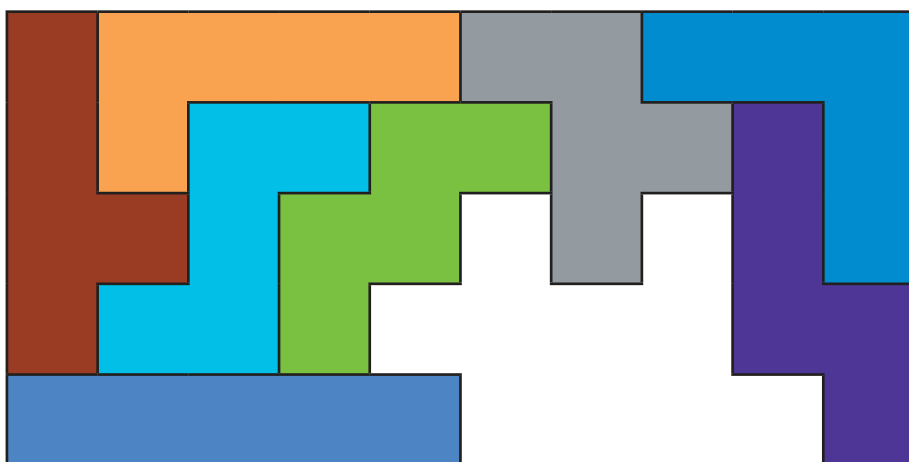
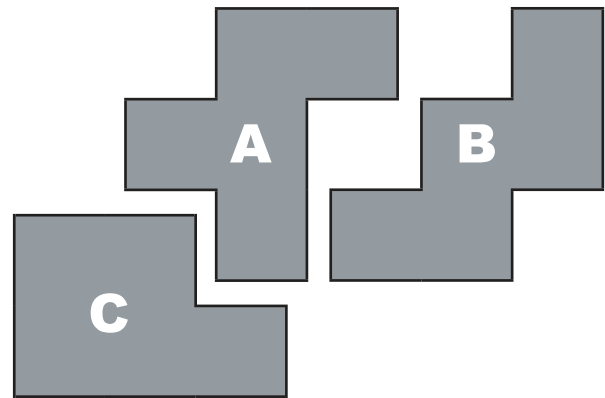
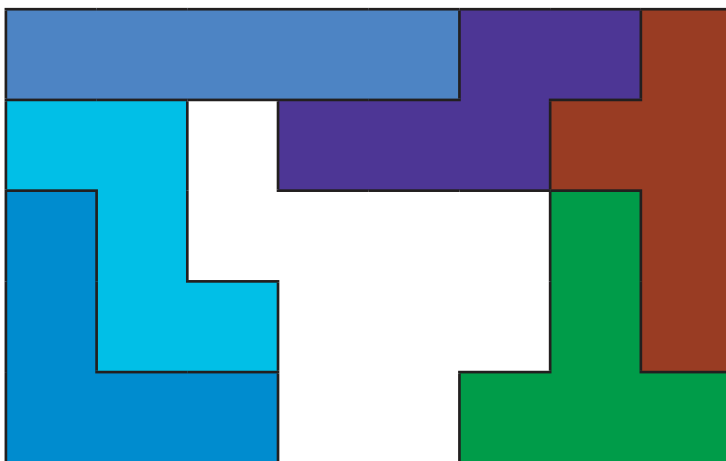
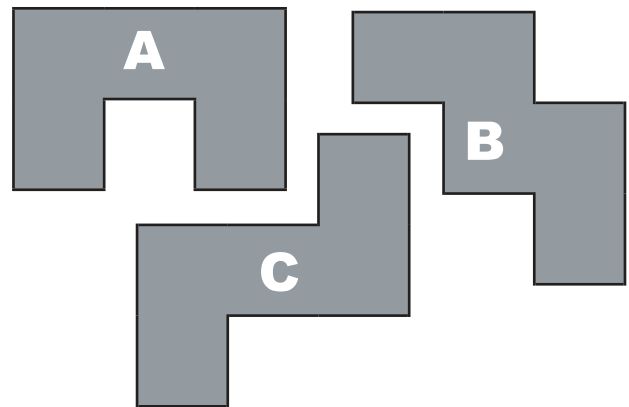
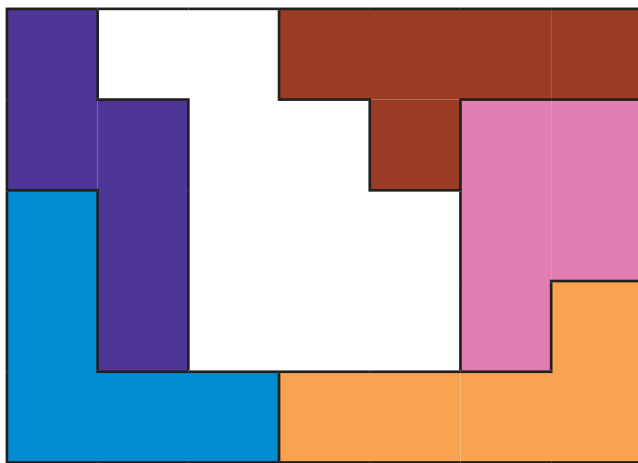
A) Choose the correct piece(s) to fill the rectangle.

Note: To reduce difficulty, it is possible to trace the outline of each square constituting the pentamino(s) to be found (on both puzzle and the pieces to pick).





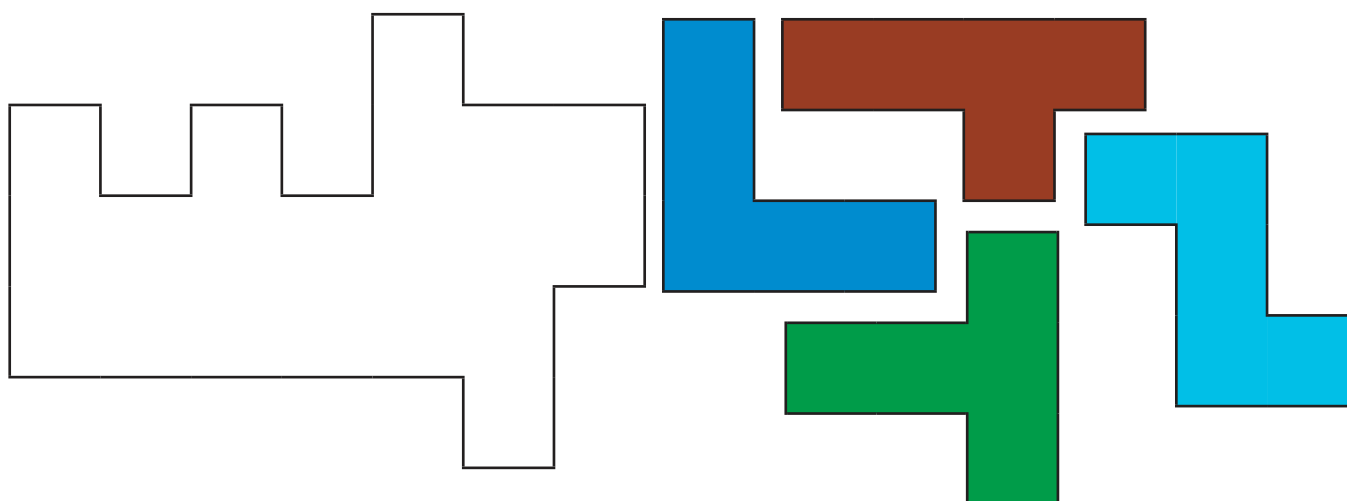
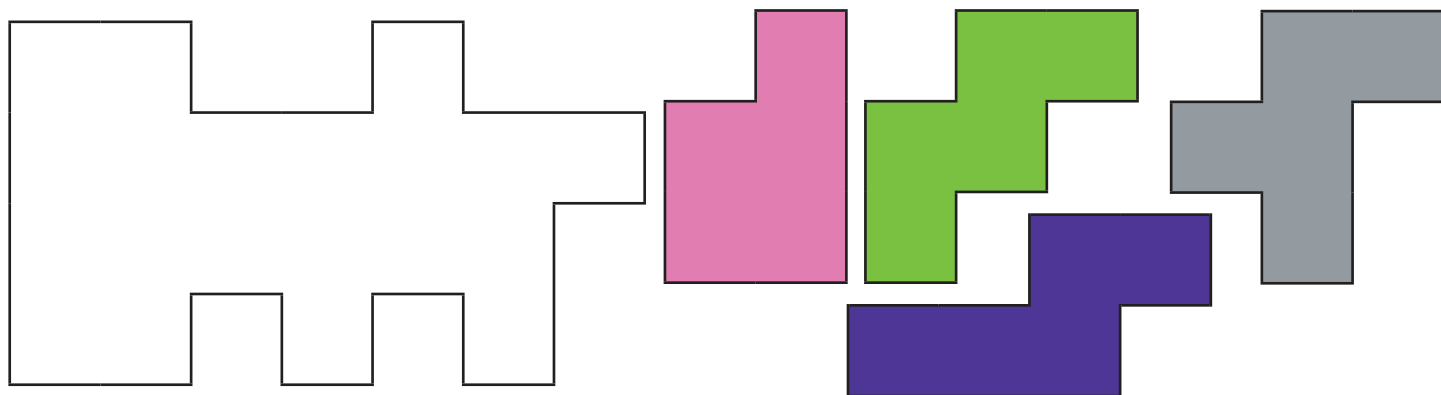
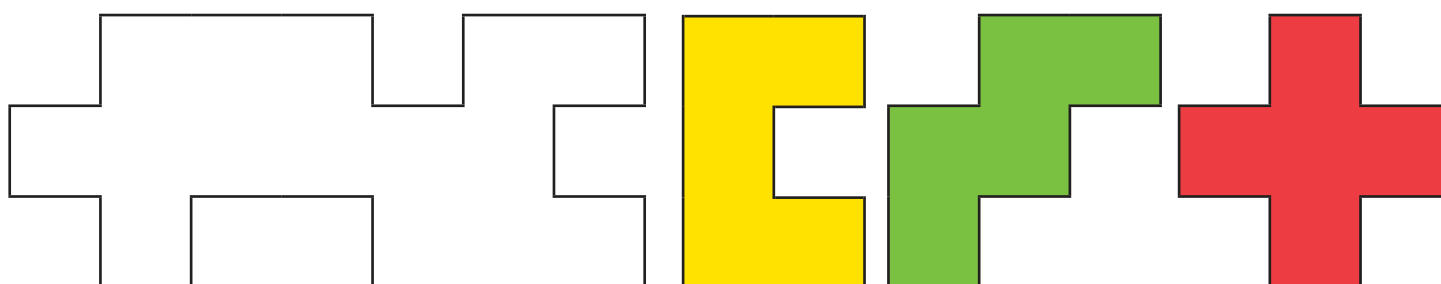
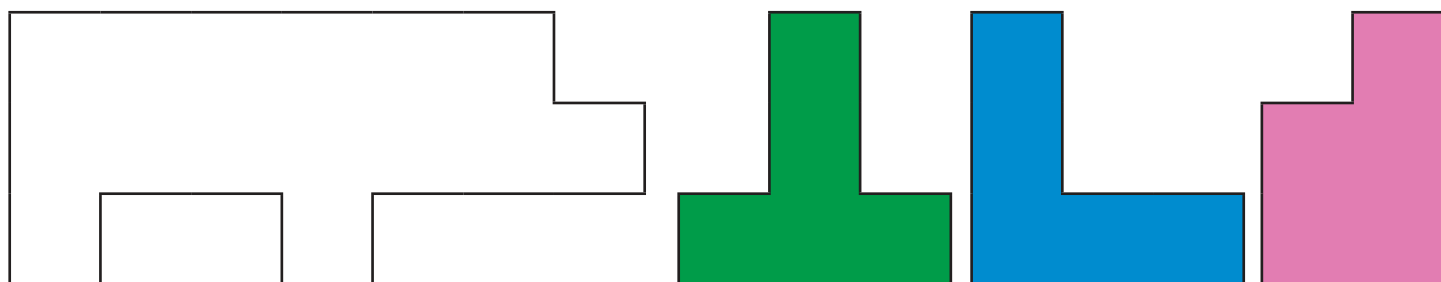
Find the 2 missing pieces.



B) Cut out the game pieces and lay them on the pattern to fill it perfectly.

Note: for exercise B, it is possible to create more examples. The teacher can put together several pentaminos flat and then draw the outline of the created shape. Give the pattern to the pupils who must complete it with the correct pentaminos.

Advice: you can work on these exercises directly with the game pieces. It will be easier for pupils to manipulate them.

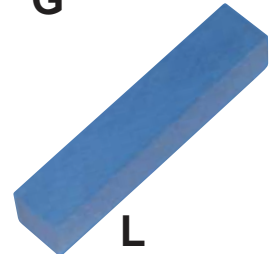
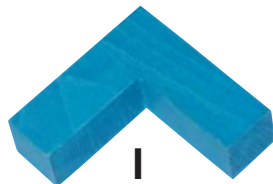
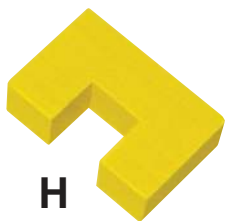
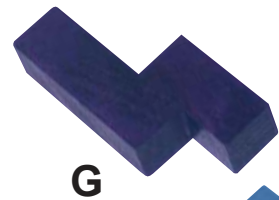
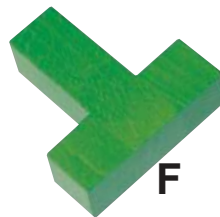
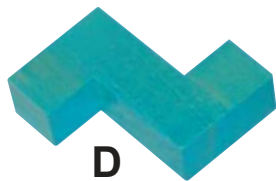
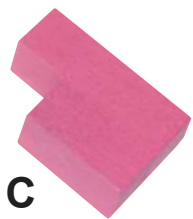
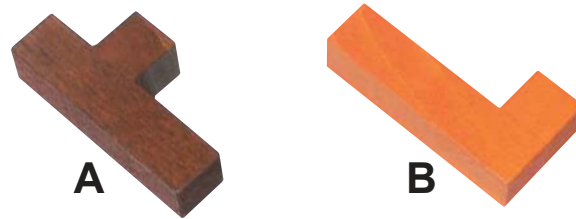
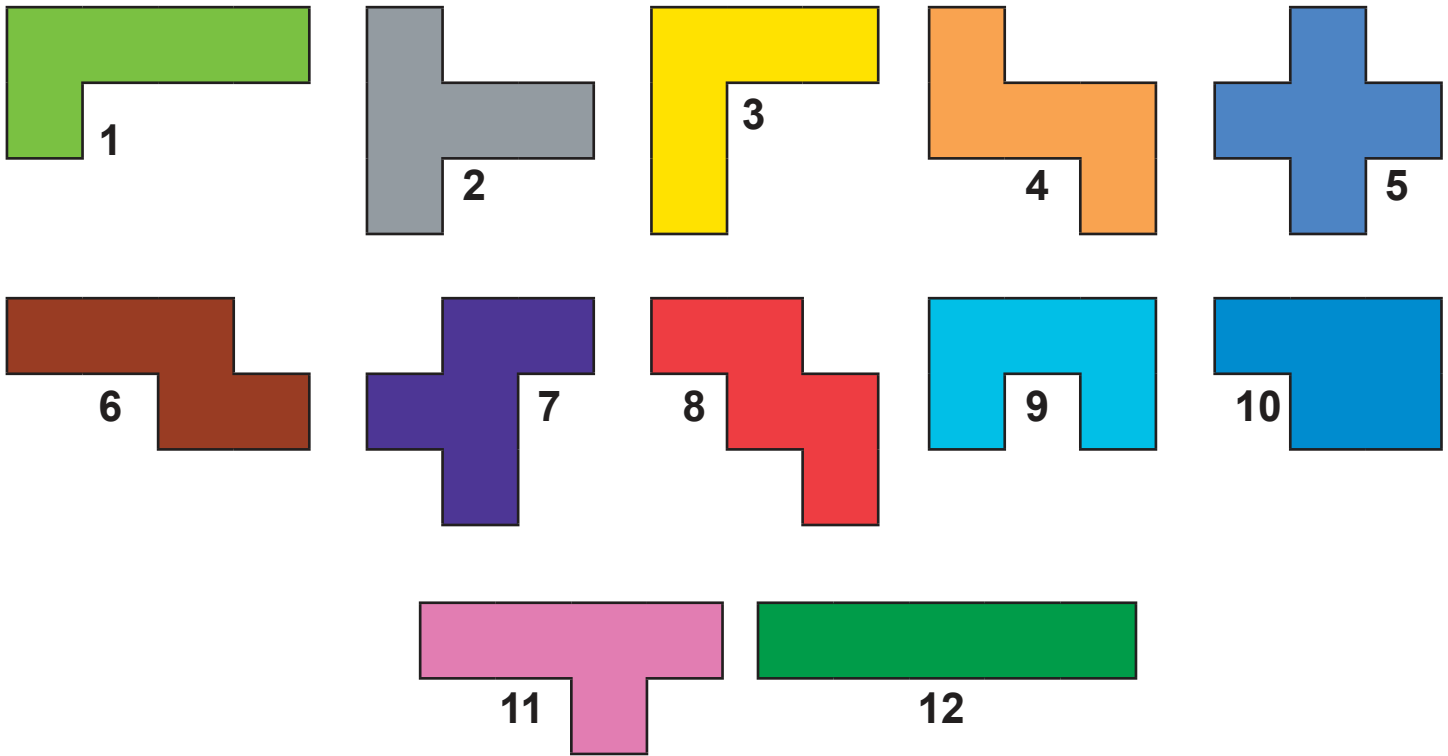


Exercise 3: match the correct figures

⇒ from a 2D to a 3D element.

Match the game pieces (3D) with their flat representations (2D).

Note, the colors should not be taken into account.



A =	B =	C =	D =	E =	F =
G =	H =	I =	J =	K =	M =

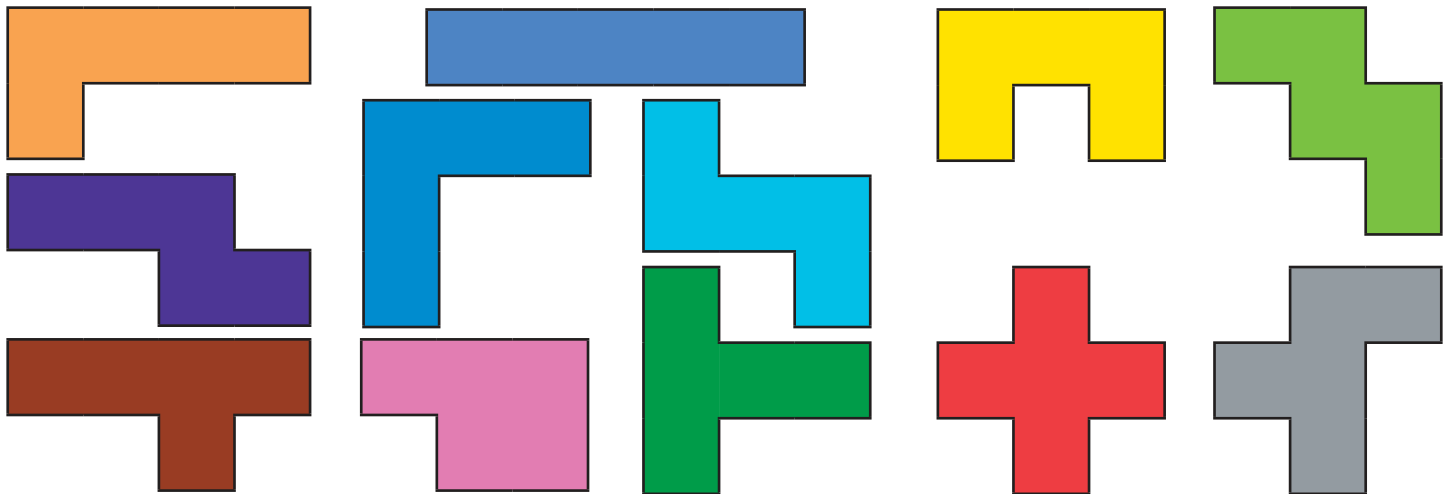
Exercise 4: Reproduce or create an image.

⇒ Manipulate shapes and develop imagination.

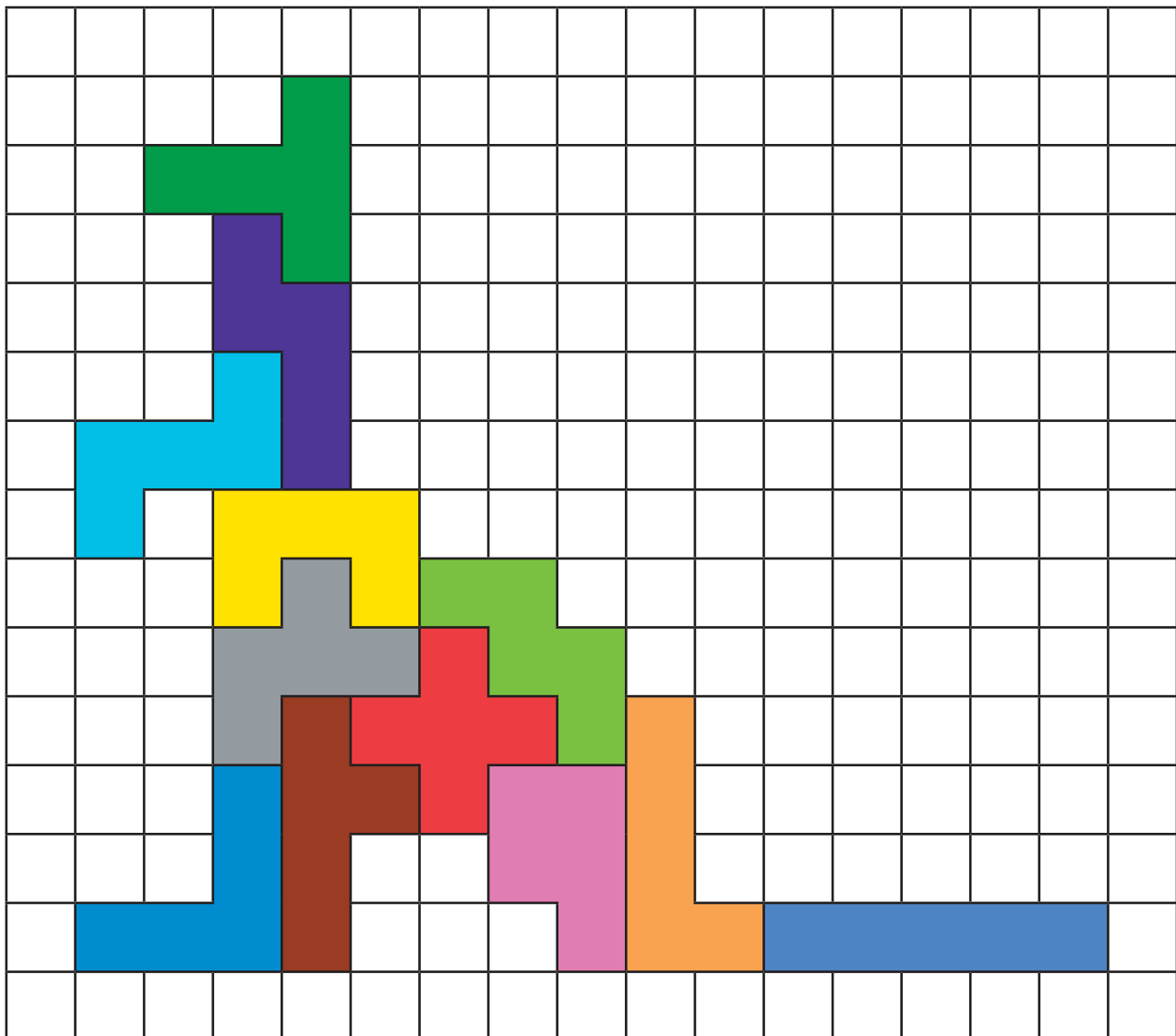
Reproduce models with the game pieces.

To increase the difficulty, it is possible to avoid showing the models or to show them in black and white in order to focus on the shapes and not on the colour of the game pieces.

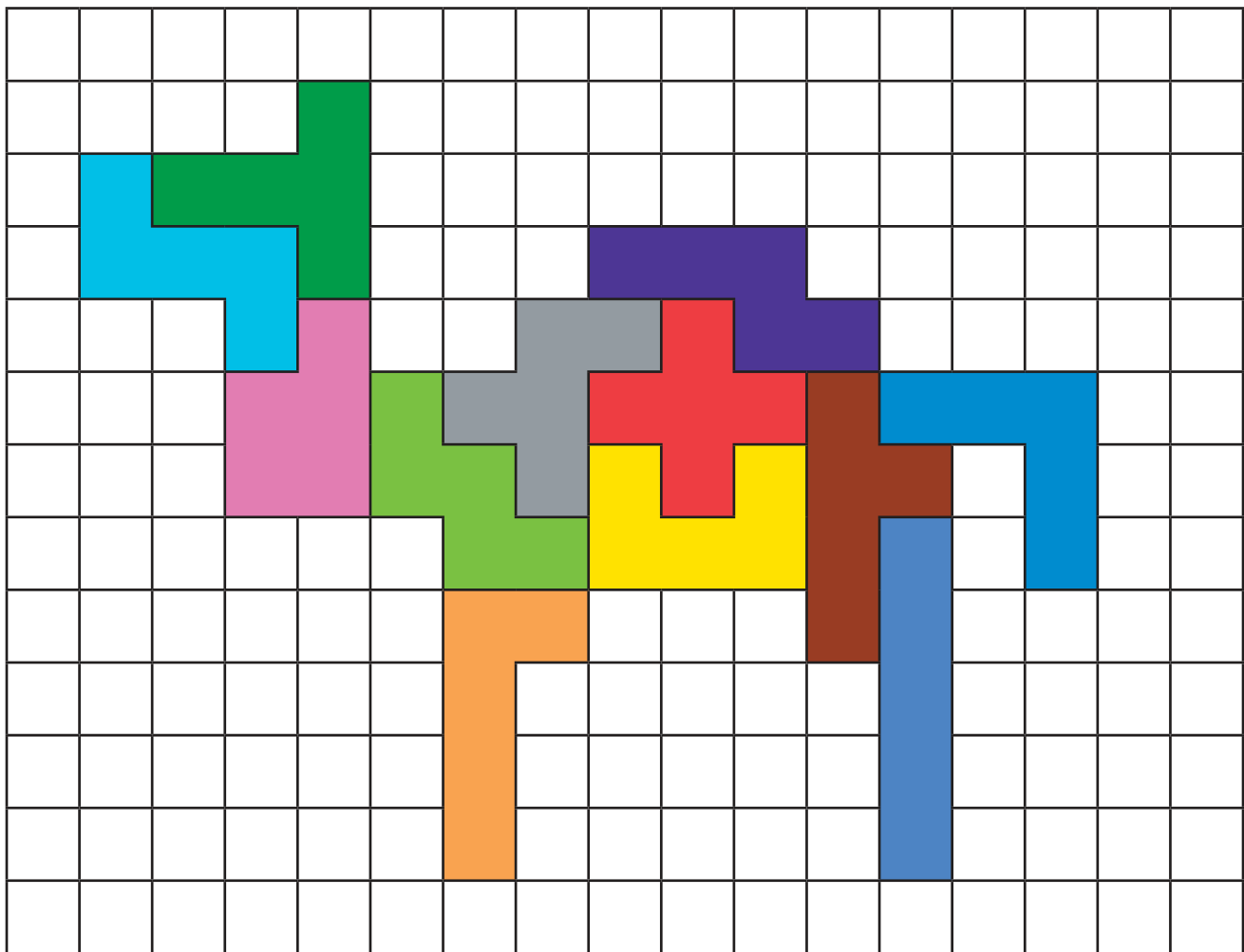
Note: it is also possible to ask pupils to create models themselves by manipulating the game pieces.



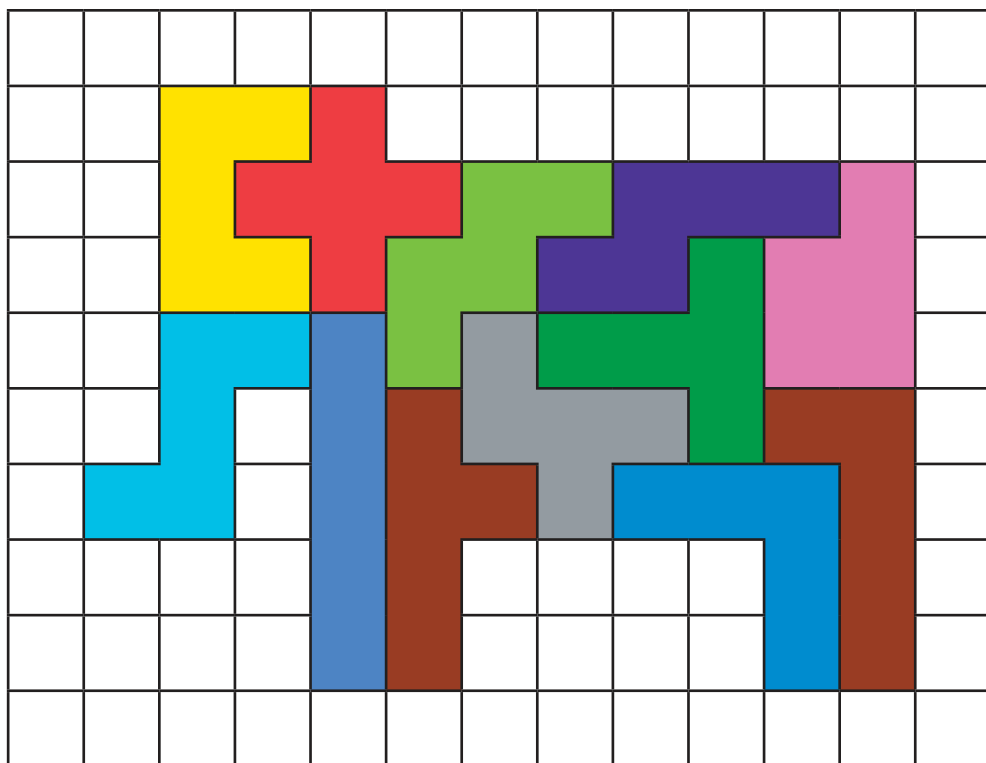
Kangaroo



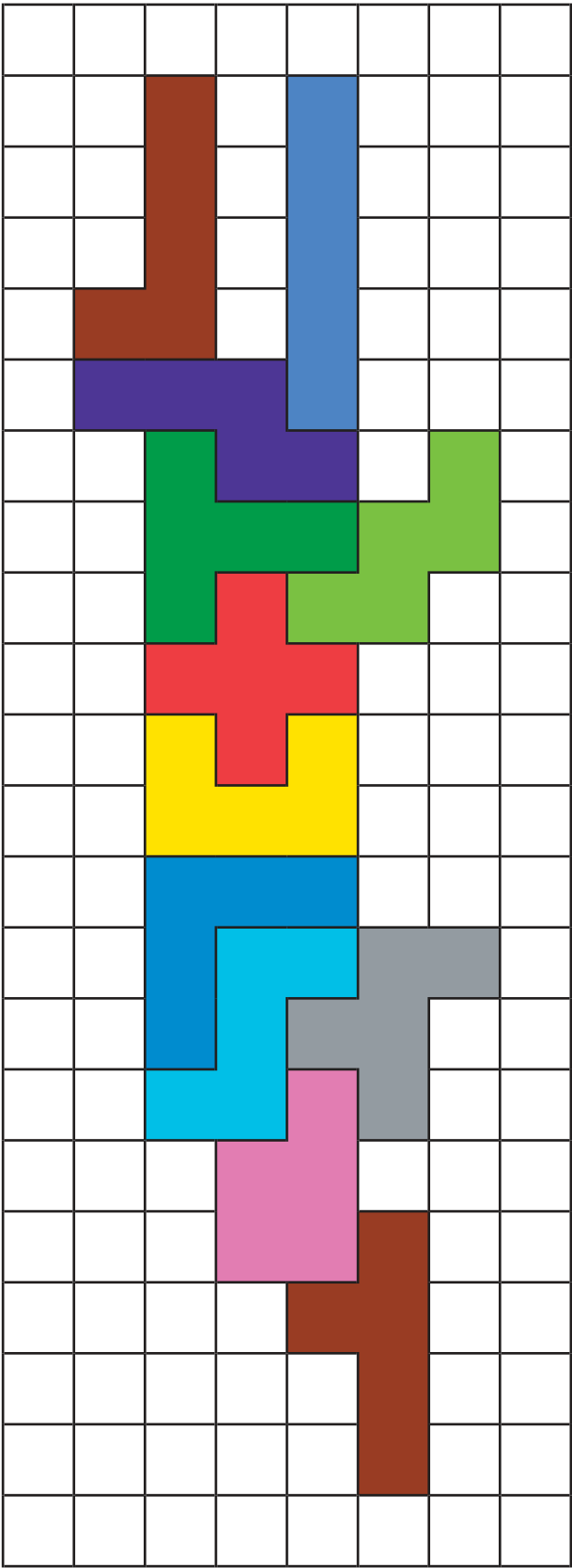
Camel



Elephant



Crocodile



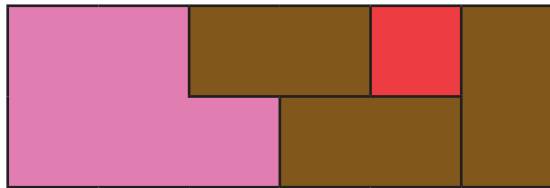
Exercise 5: build a cube

⇒ From a 2D to a 3D element.

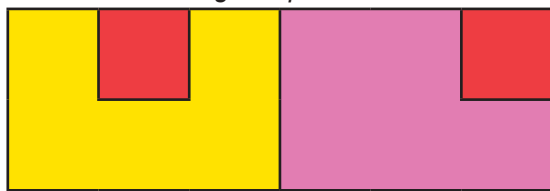
Take the indicated game pieces and build a cube according to the dimensions of the model.

Note: to increase the difficulty, it is possible to mention the dimensions of the cube to be made without showing the model to the pupils.

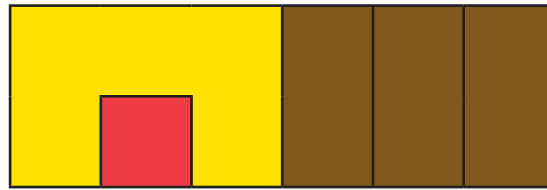
A) With the following pieces, create a cube of $2 \times 2 \times 3$, i.e. a cube made of 12 small cubes



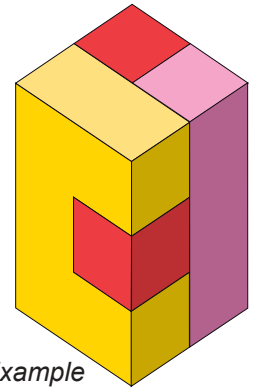
1. game pieces



2. game pieces

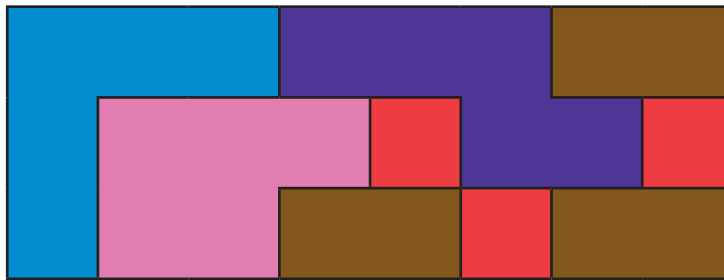


3. game pieces

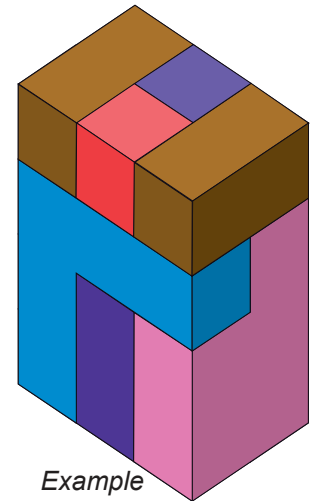


Example

B) With the following pieces, create a cube of $2 \times 3 \times 4$, i.e. a cube made of 24 small cubes



Game pieces

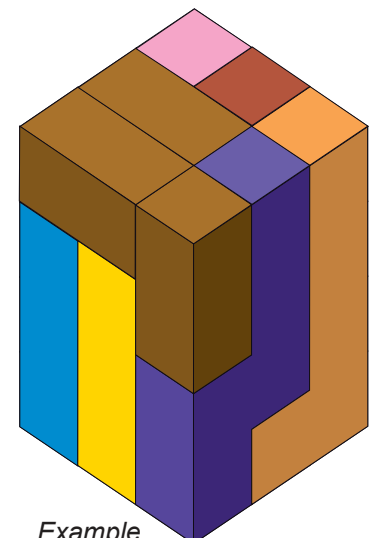


Example

C) With the following pieces, create a cube of $3 \times 3 \times 4$, i.e. a cube made of 36 small cubes



Game pieces

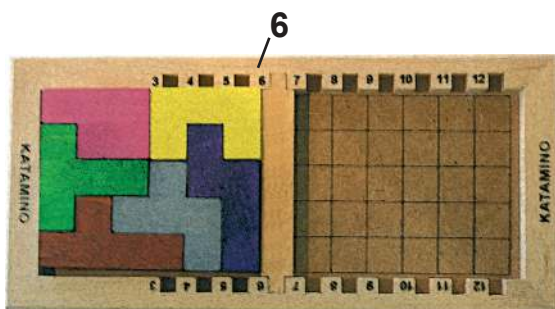


Example

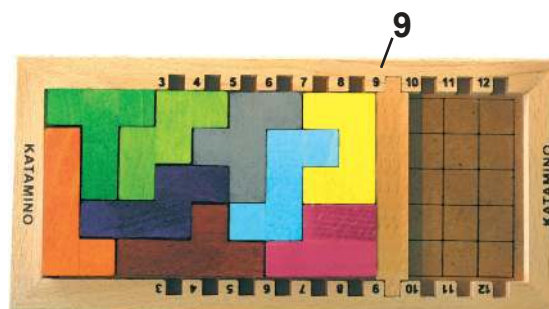
Let's play Katamino !

👏 **Play a complete game ⌚ 15min.**

Note: The following rules allow you to play Katamino with the game pieces only (without the booklet)



PENTA 6

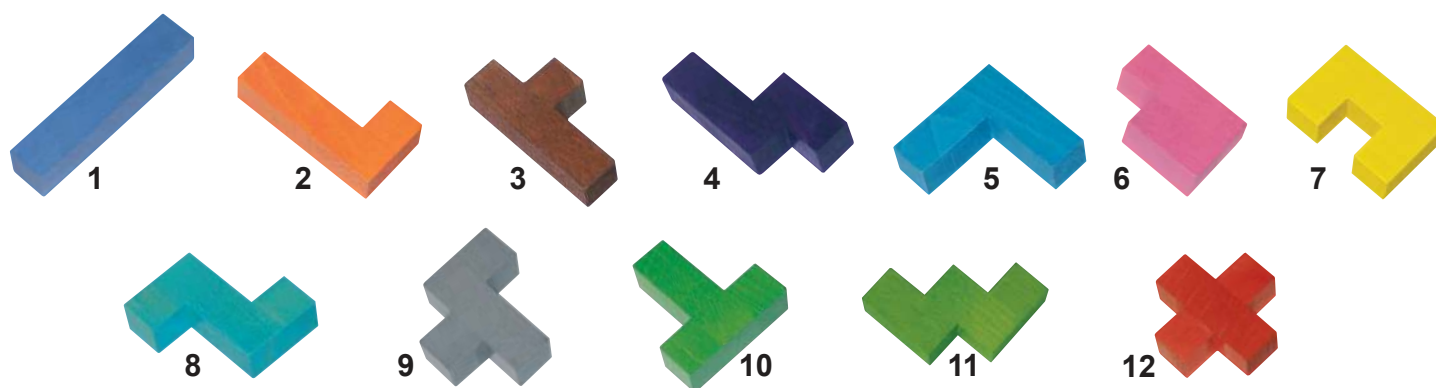


PENTA 9

⇒ Definitions

A pentamino is a game piece formed by 5 juxtaposed squares with at least one common side. (see exercise 1 and below figures)

A PENTA is a group of several pentaminos which perfectly fills the rectangle bound by the positioning of the slider. For example a Penta 6 is created by laying the slider between the number 6 and the number 7 on the game board (see below).



⇒ Summary of the rules

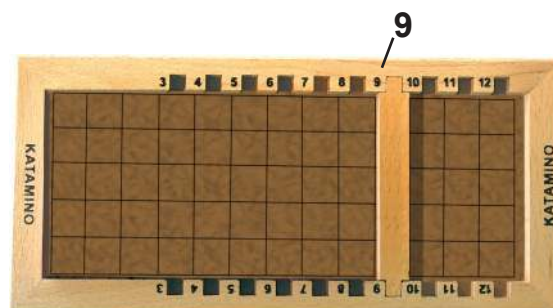
Set up: Take the pieces, the board and the slide and lay them in the centre of the table. Follow the below instructions, depending on the age and the chosen game mode.

A) VERY SIMPLE: for young children age 3 and over:

Using all the pieces, the 12 pentaminos (big pieces of different shapes and colours), the 5 small red pieces and the 3 small maroon pieces, you must completely fill the rectangle defined by the positioning of the slider.

Example :

- 1) Position the slider on the board between the numbers 9 and 10.
- 2) Place as many pentaminos as possible.
- 3) Finish filling the rectangle with the small red and maroon pieces.



PENTA 9

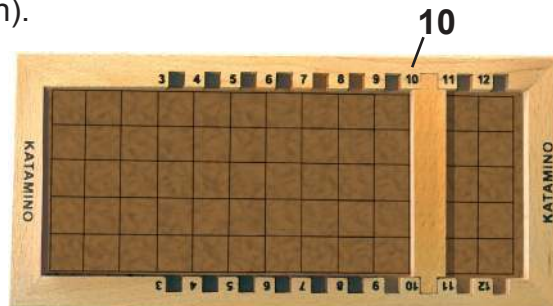


B) SIMPLE: for children age 4 and over:

Use the 12 pentaminos with either the 5 small red pieces or the 3 small maroon pieces.

Example:

- 1) Position the slider on the board between the numbers 10 and 11.
- 2) Place as many pentaminos as possible.
- 3) Finish filling the rectangle, using only the small pieces you have chosen (either red or maroon).



C) DIFFICULT: for children age 5 and over:

Use only the 12 pentaminos (the small red and maroon pieces are not used) and try to find as many PENTAS 3, 4, 5, 6, 7, 8, 9, 10, 11 and 12 as possible.

Example:

- 1) Position the slider on the board between the numbers 4 and 5 and make as many PENTAS 4 as possible by finding 4 pentaminos among the 12 that can be assembled.
- 2) Follow the same procedure to make as many PENTAS 5, 6, 7, etc. as possible.

The more pentaminos you use, the harder the game gets.

⇒ Variation of the basic game

D) Rules for 2 players -> Quick game

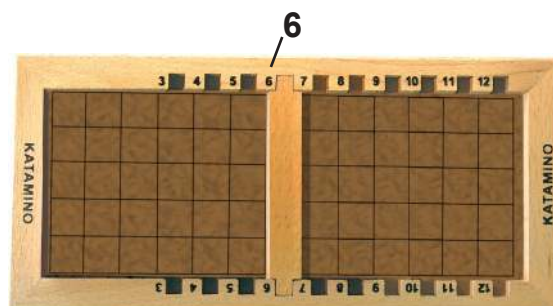
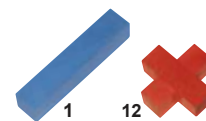
Use all the pieces, except for pentaminos 1 and 12.

One of the 2 players chooses 1 maroon rectangle, 1 maroon square and 2 red squares from the small pieces.

The other player chooses 1 maroon rectangle and 3 red squares from the small pieces.

Then both players choose 1 pentamino at a time in turn until each has 5.

Position the slider on the board between the numbers 6 and 7. Each player must fill the rectangle on his/her side of the board as quickly as possible with all of his/her pieces.



E) Rule for 2 players -> Cooperation

You can play the game mode C) in team to find a maximum of Pentas!

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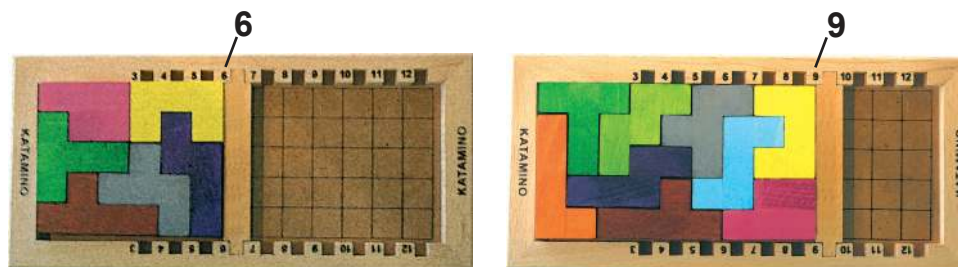
KATAMINO

SPACE GEOMETRY

LEARN THROUGH PLAY

👏 **Play a complete game** ⌚ 15min.

Note: The following rules allow you to play Katamino with the game pieces only (without the booklet)



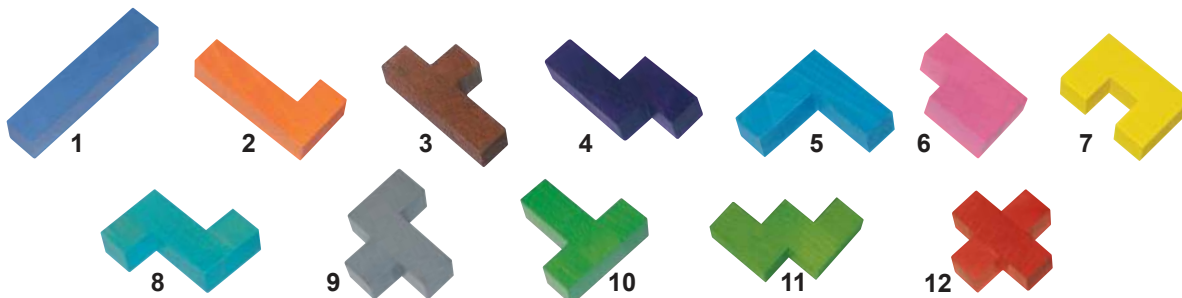
PENTA 6

PENTA 9

⇒ Definitions

A **pentamino** is a game pieces formed by 5 juxtaposed squares with at least one common side. (see exercise 1 and below figures)

A **PENTA** is a group of several pentaminos which perfectly fills the rectangle bounded by the positioning of the slider. For example a Penta 6 is created by laying the slider between the number 6 and the number 7 on the game board (see below).



AIM OF THE GAME

How to play with one player:

Use only the 12 pentaminos (the small red and maroon pieces are not used) and try to find as many PENTAS 3, 4, 5, 6, 7, 8, 9, 10, 11 and 12 as possible.

Example:

- 1) Position the slider on the board between the numbers 4 and 5 and make as many PENTAS 4 as possible by finding 4 pentaminos among the 12 that can be assembled.
- 2) Follow the same procedure to make as many PENTAS 5, 6, 7, etc. as possible.

The more pentaminos you use, the harder the game gets.

How to play with 2 players:

Use all the pieces, except for pentaminos 1 and 12.

One of the 2 players chooses 1 maroon rectangle, 1 maroon square and 2 red squares from the small pieces.

The other player chooses 1 maroon rectangle and 3 red squares from the small pieces.

Then both players choose 1 pentamino at a time in turn until each has 5.

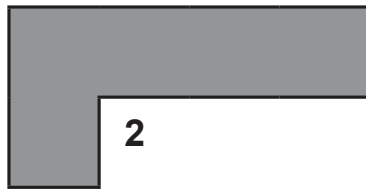
Position the slider on the board between the numbers 6 and 7. Each player must fill the rectangle on his/her side of the board as quickly as possible with all of his/her pieces.

Words to keep in mind:

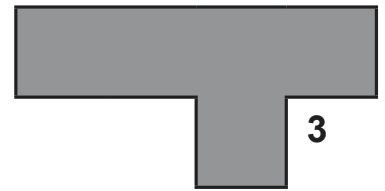
Rectangle, cube, square, pentamino, figure, volume, side, delimit, juxtapose, space geometry, 2D, 3D.



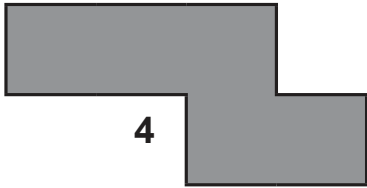
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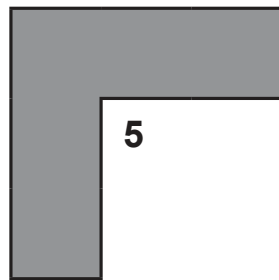
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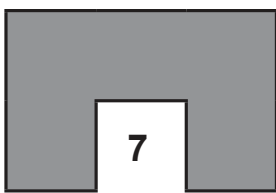
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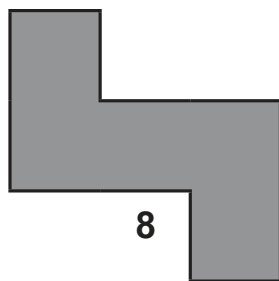
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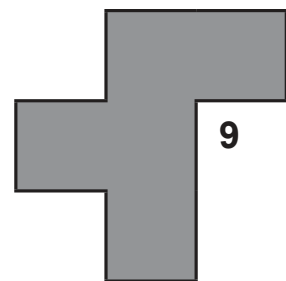
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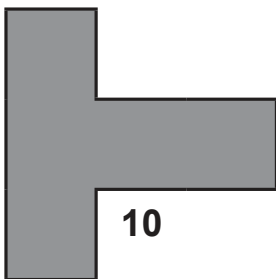
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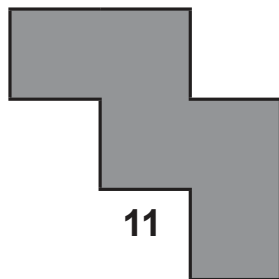
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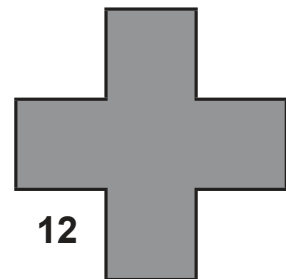
9



10



11



12

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