(ENG) What do the ancient Egyptians have in common with setting up a wardrobe?

Introduction

#In-class activity #Inquiry-based learning #Experimental learning #Gamified learning #Simulation #Teamwork

The pupils will assemble the squares, master the Pythagorean theorem and consolidate it with an example. Pythagoras' theorem is the basis for calculating the unknown third side in a right-angled triangle and, simultaneously, the basis for understanding angular functions in higher classes. The Pythagorean theorem is used to calculate the lengths of diagonals in rectangular shapes and bodies with rectangular vertices. Finally, in everyday life, we encounter Pythagoras' theorem on how high a ladder reaches, measuring the right angle in nature, etc.

Right-angled triangles are the basis of Pythagoras' theorem and are also found in art. They are especially evident in geometric abstraction but are also found in other works, especially when encountering right angles.

Learning Objectives

- [ ] Define Pythagoras' theorem
- [ ] Use the Pythagorean theorem to calculate an unknown page length in a right-angled triangle
- [ ] Aapply it to solve a text task in a geometric plane (with and without a calculator)

ACTIVITY DETAILS

Activity Details

Connection of the activity with Art

Cutting, painting, collage, drawing

We encounter right-angled triangles in everyday life, such as at the height of a raised ladder and in Art. Right-angled triangles are emphasised in pieces based on geometric elements.

Link to local, national School Curriculum

Geometric concepts/Pythagorean theorem

Equipment required

- a computer connected to the web, a printer,
- a ruler,
- a pencil or another pen,
- A4 paper,
- Colours.

Duration of activity

45 minutes

Sources

Vector sketches are free for commercial use.

Figure 1: Multi-Colored Triangle, 1927 (https://commons.wikimedia.org/wiki/File:Kandinsky_-_Multi_Colored_Triangle,_1927.jpg)

Step 1 - Motivational Stage

Explain to pupils:

In the time of the Egyptians, they knew that a triangle is right-angled if the sides are in a 3: 4: 5 ratio. We call such a triangle the Egyptian Triangle. With the Egyptian Triangle, they determined the right angles on the lands where the annual floods blurred the boundaries on the ground. Pythagoras' theorem describes the connection between the sides in a right-angled triangle. (Mathematics 8)

Right-angled triangles are found in art. An example of using right-angled triangles in art is a geometric abstraction. Geometric abstraction is based on geometric shapes that do not represent our visual world but use geometric elements. The forerunner of non-objective painting was Wassily Kandinsky, who used right

triangles in his geometric abstractions. Some of his works are the "Multi-Colored Triangle" (1927), "Composition VIII." (1923), and "With the Triangle" (1938).

Figure 1: Multi-Colored Triangle, 1927

Everyday life problem

Explain to pupils:

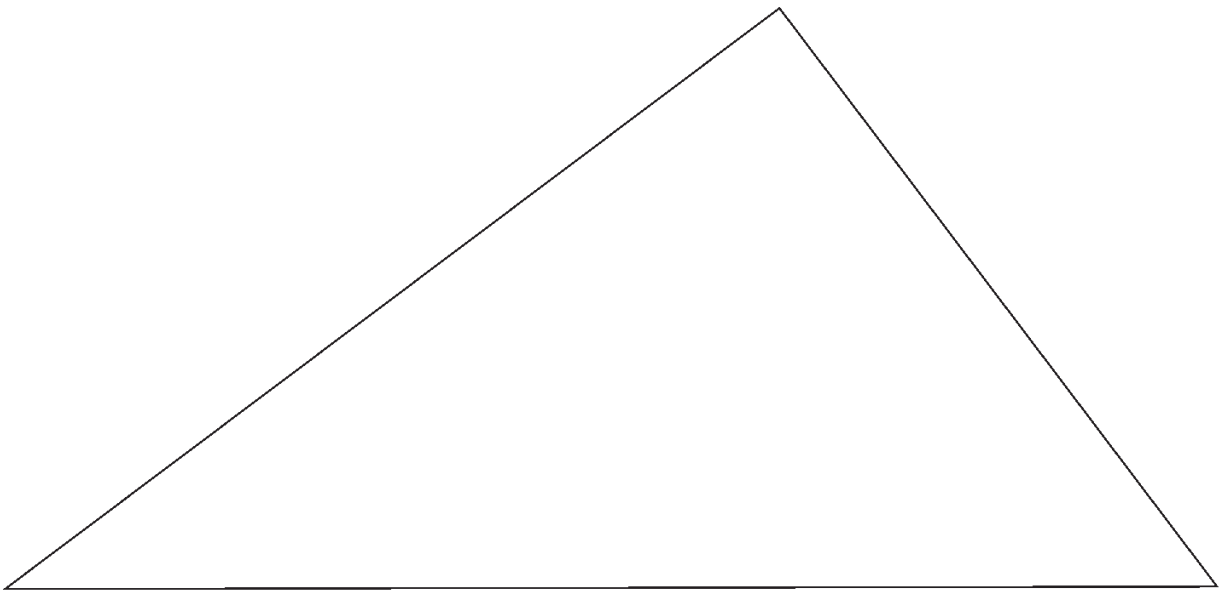
When we buy wardrobes in the store, we often have to assemble the cabinets ourselves. We usually build larger pieces of cabinets on the floor. Can I construct a wardrobe in the shape of a square on the floor and then lift it upright if the dimensions of the closet are: height (**h**) = 2.15 m, width (**w**) = 0.45 m, and depth (**d**) = 0.60 m in a room with a ceiling height of 2, 20m? ?r would the wardrobe stuck from the corner, when you try to lift it up?

Consolidation of already known content

Explain to pupils:

Right-angled triangle:

Draw a right-angled triangle and mark the sides and angles. Next, draw a right angle in the picture and name which two sides are the catheti and which side is the hypotenuse?



Step 2 - Investigational Stage

STUDENTS' TASKS

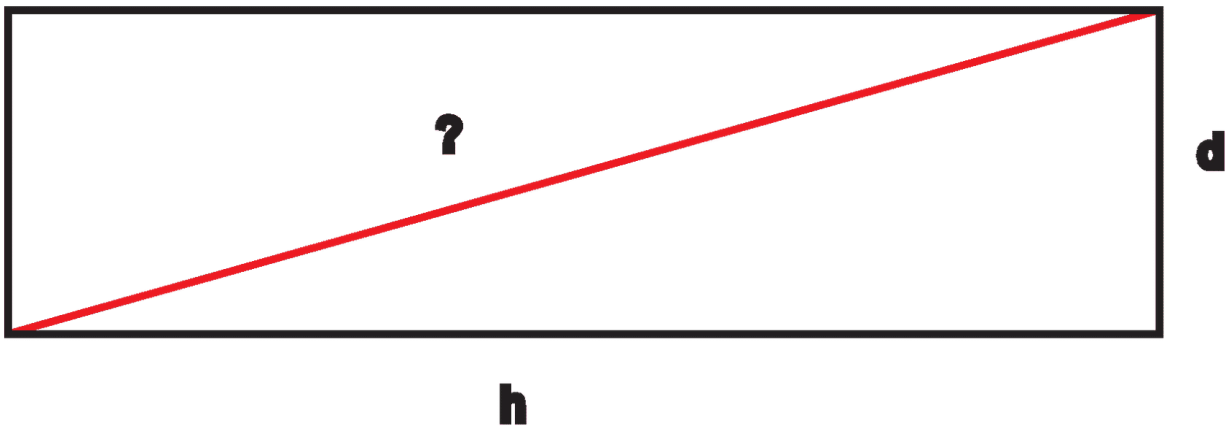
1

Task 1

Explain to pupils:

We have to find out whether the constructed wardrobe can be lifted from a lying position to an upright position. First, it is necessary to determine its maximum height regarding the lifting process. The maximum

height is the diagonal of the wardrobe.



We can observe that the diagonal (coloured red) divides the rectangle into two right-angled triangles, with the shorter sides of the wardrobe h and d being the catheti of the triangle. The longer side (the diagonal) is the hypotenuse of the triangle. We use the Pythagorean theorem to calculate the diagonal.

2

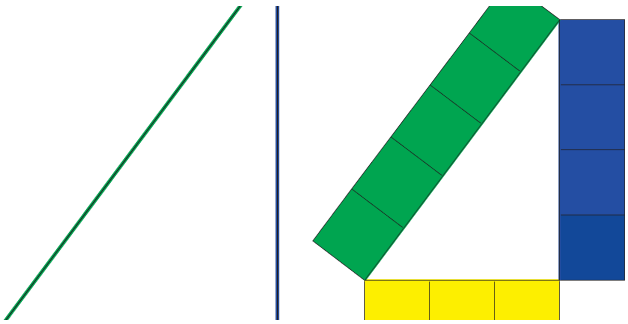
Task 2

Pythagoras' theorem

Explain to pupils:

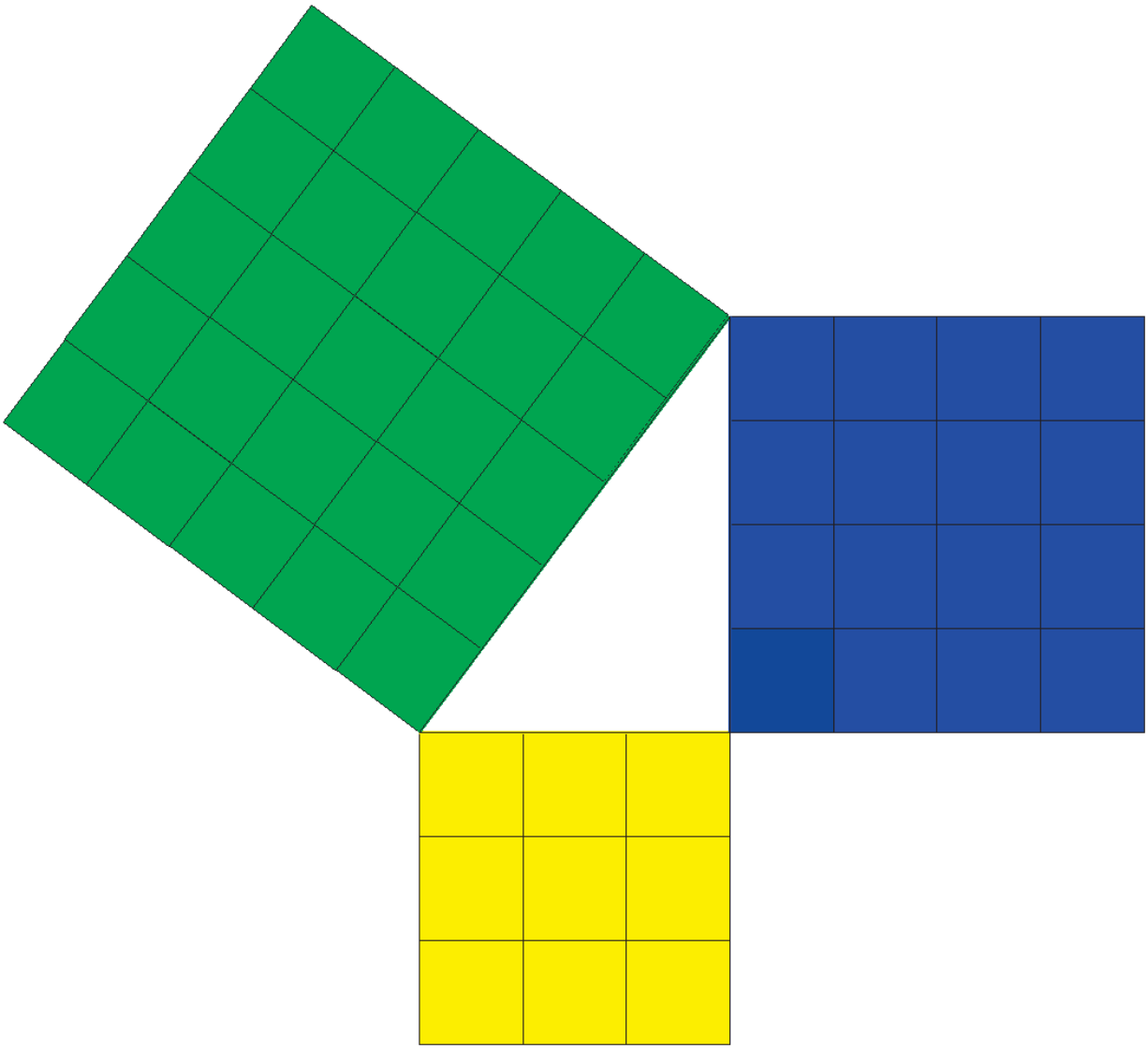
To understand Pythagoras' theorem, print out the attached document Pythagoras.pdf. Next, cut the right-angled triangle and squares along the lines. If you do not have a printer, draw a right-angled triangle and a grid of squares with dimensions as in the attached document "Pythagoras.pdf". Then cut along all the drawn lines. I suggest you colour the squares as in the document. There must be at least 50 squares.

Place a right-angled triangle on the table and place squares along the length of each side as in the picture:



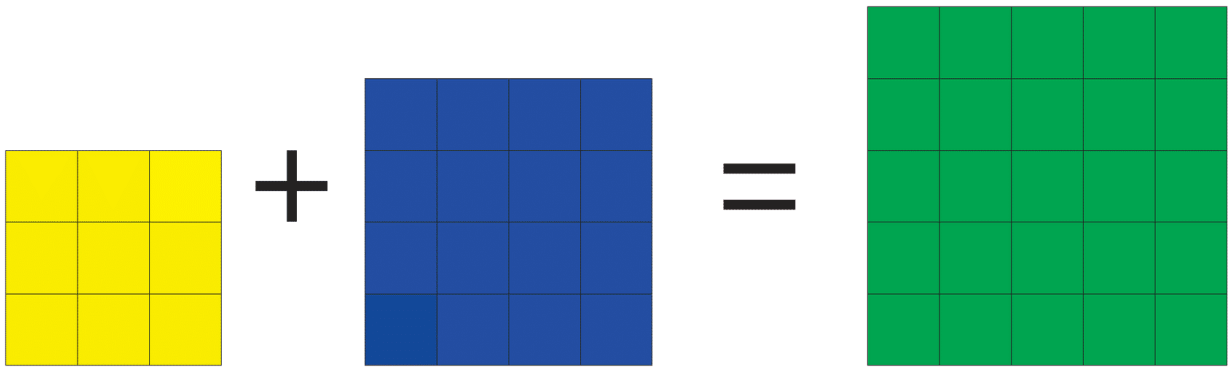
You find out that the length of the yellow side is three squares, the blue side is four squares, and the green side is five squares.

Place the squares next to each side. You get a square with a side length equal to the side of the triangle. Count how many squares there are on each side. See the picture below.

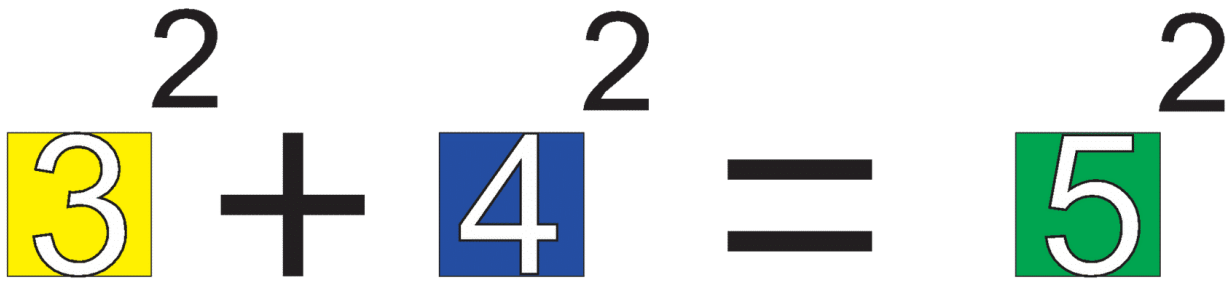


There are 9 squares on the yellow side, 16 squares on the blue side and 25 squares on the green side. The number of squares is also the area of a square lying on the same coloured side.

The number of all yellow and all blue squares is 25, which equals the number of all green squares.



The sum of the squares of the catheti lengths is equal to the square of the hypotenuse length. Thus, we can write the Pythagorean theorem:



The pages are also named with tags:

$$cathetus_1^2 + cathetus_2^2 = hypotenuse^2$$

or

$$a^2 + b^2 = c^2$$

Summary

Explain to pupils:

The Pythagorean theorem applies only in right-angled (90°) triangles. The form for the Pythagorean theorem is

$$a^2 + b^2 = c^2$$

where sides **a** and **b** are the catheti, and side **c** is the triangle's hypotenuse. With the help of the Pythagoras theorem, you can also check whether a triangle is a right-angled triangle since equality in Pythagoras' theorem matches only in a right-angled triangle.

Step 3 - Consolidation Stage

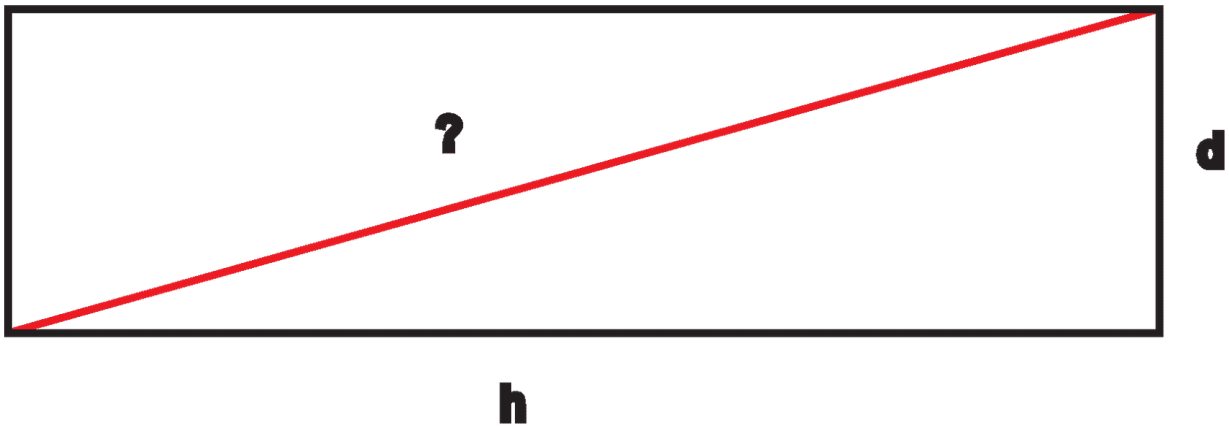
Explain to pupils:

pupils solve the following tasks to check their understanding of the lesson:

1

Task 1

Can I construct a square-shaped wardrobe on the floor and then lift it upright if the dimensions of the wardrobe are: height (h) = 2.15m, width (w) = 0.45m and depth (d) = 0.60m in a room with a ceiling height of 2.20m?



Now solve the task of the wardrobe layout. The catheti are shorter sides, and the hypotenuse is the desirable diagonal.

$$h^2 + d^2 = ?^2$$

Answer:

Can you set up the wardrobe?

Is there any other option to put the constructed wardrobe upright?

Task 2

Check if Wassily Kandinsky depicted a right-angled triangle for the largest triangle in the painting "Multi Colored Triangle"? (Measuring gives only approximation)

Additional downloadable materials

PDF

Pitagora_OS_Litija.pdf

381 KB

End of the activity

EXIT