

## Good practices MATH\_102BC\_EN

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Description of the problem / exercise: **Two-master ship**

The task belongs to the topic of combinatorics. Used sets: square, triangle. The following picture shows a two-master ship with 2 triangular sails on each mast. The different base colors of the sails mean different speeds. The sum of the speeds corresponding to the colors gives the final speed of the ship. Yellow moves the ship forward with a speed of 1 km/h, red with 2 km/h, green with 3 km/h and blue with 4 km/h.

a) How fast is the ship in the picture moving?



The left mast carries one red and one green base color sails, and the right mast carries one yellow and one blue base color sails. So exactly one piece of each base color. In this case the speed of the ship is  $1+2+3+4 = 10$  km/h.

b) Change the color of the sails so that the boat is traveling exactly with a speed of 13 km/h.

The essence of the task is to create a given sum using the numbers 1, 2, 3, 4.

There are several solutions to the problem and one of them is e.g. 3 green and 1 blue sails, ie  $3 \times 3 + 1 \times 4 = 13$  km/h.



Note: Of course, the task can also be given so that students look for more possible solutions or as many solutions as possible. In the more difficult version of the exercise, we can take into account the position of the sail, i.e. whether it is on top or bottom of the first or second mast.

c) Change the color of the sails so that the boat is moving with the lowest possible speed.

The minimum speed corresponds to the yellow base color, so all sails should be yellow base color. Then the ship is moving at a speed of  $4 \times 1 = 4$  km/h.



d) Change the color of the sails so that the boat is moving with the highest possible speed.

The maximum speed corresponds to the blue base color, so all sails should be blue base color. Then the ship is moving at a speed of  $4 \times 4 = 16$  km/h.



- *Why this exercise is good:* Develops problem solving, logical thinking, inductive thinking, and combinatorial thinking.
- *Level of teacher training:* Primary school upper grade, secondary school
- *School subject(s):* Mathematics