



Teaching unit

Title	Travelling on a map with vectors
Age of students/ grade	Secondary School students (13-14 years old)
Length of the unit	Approximately 2 lessons of 50 minutes each
Materials needed	Online or paper maps, tools for Geometry
Objectives	<ul style="list-style-type: none">• modelling a journey using pairs of vectors• using computer tools in Mathematics (Geogebra, a spreadsheet)• developing students' ability to collect, analyze and study a range of data• cooperating in a group of students
Content related anchor points	<ul style="list-style-type: none">• vectors - properties of vectors• vector idea as a pattern of movement (movement of a ship or a bird moving in one direction, influence of wind)• sum of vectors, linear combination• idea of interval or base of a vector space• creation, reading and interpretation of graphs (on paper or on computer)• the trip can be at sea, in the air, on the road or virtual

Methodology related anchor points	<ul style="list-style-type: none"> • Teamwork • Presentation of results in front of the whole class • Use of electronic devices and instruments. • Interdisciplinary work - collaboration with other teachers • Use of maps (real or invented)
Language related anchor points	<ul style="list-style-type: none"> • Basic lexicon related to coordinate Geometry • Some geographical concepts

LESSON PLAN

Lesson 1

The topic could be a bit challenging considering the level of the chosen class. However, it has the advantage of being able to work with geographical and road maps that come from various countries, including those of foreign students.

The material to be used can also be found by collaborating with teachers of other subjects such as Geography and Technology.

It allows you to reflect on the differences between scalar and vector sizes.

The teacher should initially present to the class the 2 mathematical terms "scalar " and "vector": a scalar size is defined by a number and by its unit of measurement while a vector size is defined by a number (module) but also from a direction and a verse.

Kids can try to mention which of the known sizes can be of one type or another.

Going on with the work, possibly in groups, the teacher will ask the students to measure the distances between two places on a map or a road map.

Then the teacher will ask them to calculate the necessary route by following the roads.

The design of vectors will be accompanied by verse and direction. This should lead them to realize that the path traced cannot always have the same verse and direction.

Most likely there will be a difference between the measured distance and the length of the path traced along the roads. Summing vector quantities is not like summing scalar quantities.

In fact, displacements are not algebraically summed,, as seen in the example below:



At this point the students will describe the path, and they will be asked, even on the basis on their experiences, to give examples in which the vector sum does not correspond to the scalar sum.

For example: if you drink half a liter of water and then another half liter, you will drink a liter of water altogether. If instead you make a 1 km shift from point A to point B and then you move another Km from point B to point C, not necessarily the total displacement will be 2 km: it could be even smaller.

As a task the teacher can propose to the students to prepare examples of one case and the other, and then discuss them in class during the following lesson.

Lesson 2

The teacher will begin by discussing the paths traced on the maps, trying to bring into the discussion the foreign students, who can also talk about their experiences.

At the end of the discussion, the teacher will propose to sum the vectors (triangle method and parallelogram method), as a general procedure compared to the evaluations made in class by tracing the paths.

If possible, the teacher can try to solicit the discussion on how in reality the sum of vectors is more common than you think, leading to reflect on the forces and on how those are applied, so that you can have opposite results despite they have the same intensity.

For example, the students can be actively involved in the discussion by proposing to move a desk using forces of the same intensity and verse, but opposite directions or with the same intensity, verse and direction.

Although from the conceptual point of view it could be challenging, this type of teaching unit could allow, through practical applications, the participation of foreign students, thus leading to the acquisition of the mathematical concept of vector quantity.