TEACHING UNIT VIII
MATHS

Graphical solution of geometrical problems through Geogebra

IINTERNATIONAL TEAMWORK AS A METHOD TO MAKE OUR SCHOOLS INCLUSIVE OF DIVERSITY

Erasmus+

PROJECT N. 2014-1-ES01-KA201-003342_1

TEACHING UNIT ITALY III

MATHS: Graphical solution of geometrical problems through Geogebra

1. INFORMATION:

a. **Date:** September 25TH
b. **Level:** Maths: 15-16, Language: B1
c. **Subject:** Maths/Geometry
d. **Theme***: Graphical solution of geometrical problems: beyond equations, without thinking of getting rid of them*
e. **Teacher***:* Massimo Pamini

2. AIMS/GOALS :

- The main goal is to show how Geogebra can enhance students' capabilities and perspectives.

3. COMPETENCES/SKILLS (Which competences/skills will you develop in this unit):

- Mainly competences and skills related to problem solving

4. METHODOLOGY

a. **Type of lesson:**
   - 20% of the time will be devoted to instruct and explain; the remainder, for group work and group evaluation.

b. **Type of interaction (organization in classroom):**
   - Multinational groups of 3-5 students will be formed. Each member must know what the group has produced.

c. **Teaching aids: (like digital board, pc's ...):**
   - The position of the students' desks should allows an effective face to face interaction within each group; a digital board or projector that can receive the input from the teacher's laptop; one pc per group with the last Geogebra version with commands in English**.**

5. TEACHING:

a. Contents:

- To get acquainted with Geogebra's geometry view; quick recap on the properties of the perpendicular bisector; how to construct the tangent to a given circumference; how to use an approximate construction to approach the solution of a problem. Solution of problems through Geogebra

b. Activities: The following problems are the core of the lesson and must be solved by construction:

1) The length of the sides of a triangle are 4, 5 and 7 respectively. Determine the area of the triangle.
2) The length of the perimeter of an isosceles triangle is 12 and the perperdicular distance of the vertex to the base is 3. Determine the length of the sides of the triangle.
3) The length of the base AB of an isosceles triangle ABC is 10. Let CD the altitude to the base. If the length of CD+BC is 9, determine the length of CD.
4) Determine the area of a right-angled triangle where the length of one of the two (mutually perpendicular) sides is 10 and the length of the altitude to the hypotenuse is 6.
5) Determine the area of a right-angled triangle ABC (AB is the hypotenuse, CD is the altitude to the hypotenuse, AD is the projection of AC on AB and DB is the projection of CB on AB) where AC-AD=9.6, DB=25.6 Determine the area of a right-angled triangle

6. EVALUATION:

a. Group evaluation

Graphical solution of geometric problems

Beyond equations, without thinking of getting rid of them

What is it usually done to solve a geometric problem?

- Read the text as carefully as possible;
- Sketch the shape, recall its properties and the main theorems (Pythagoras' above all);
- Set the unknown and write down the equation which solves the problem.

A simple problem

In a right-angled triangle, the length of one of the sides is 4 and the sum of the measures of the hypotenuse and the other side is 12. Determine the lengths of all sides.

If side1=4 and side2=x then hypotenuse=12-x.

By Pythagoras' theorem: $16+x^2=(12-x)^2$.

By solving the first degree equation we get

x=16/3 and our task is fulfilled.

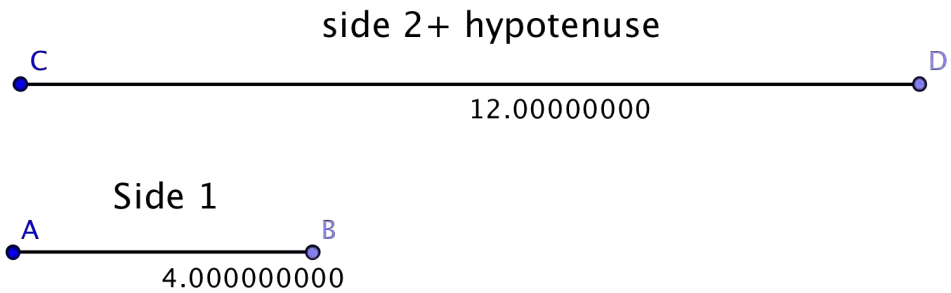
But, isn’t there another way to solve this problem?

- Yes, there is. We could start from the given geometric elements and construct the shape with huge precision.

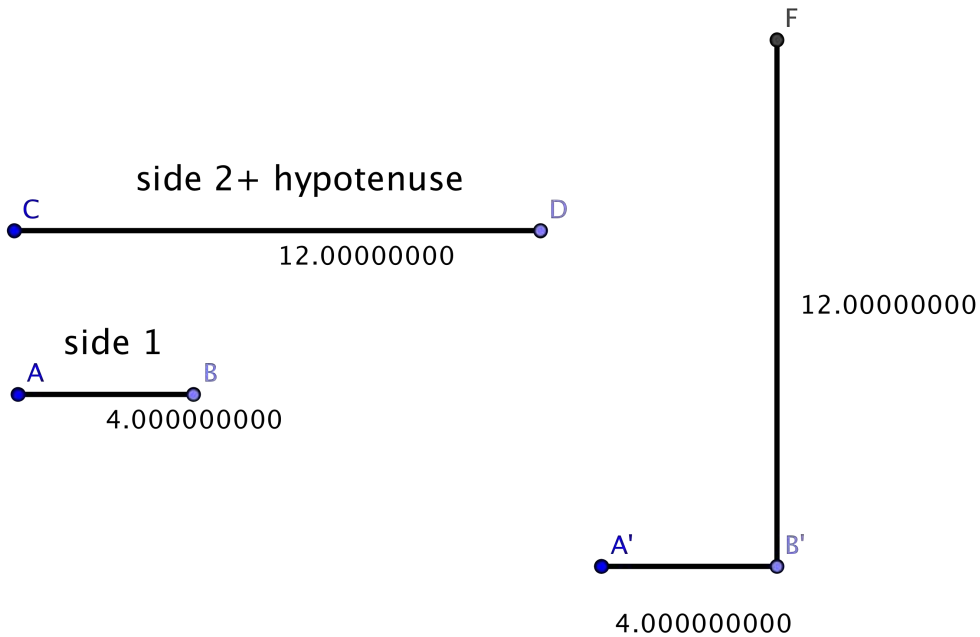
- Then we can measure and determine all the elements we wish to find.

- There are some applications that allows us to try this path. One of these great tools is GeoGebra.

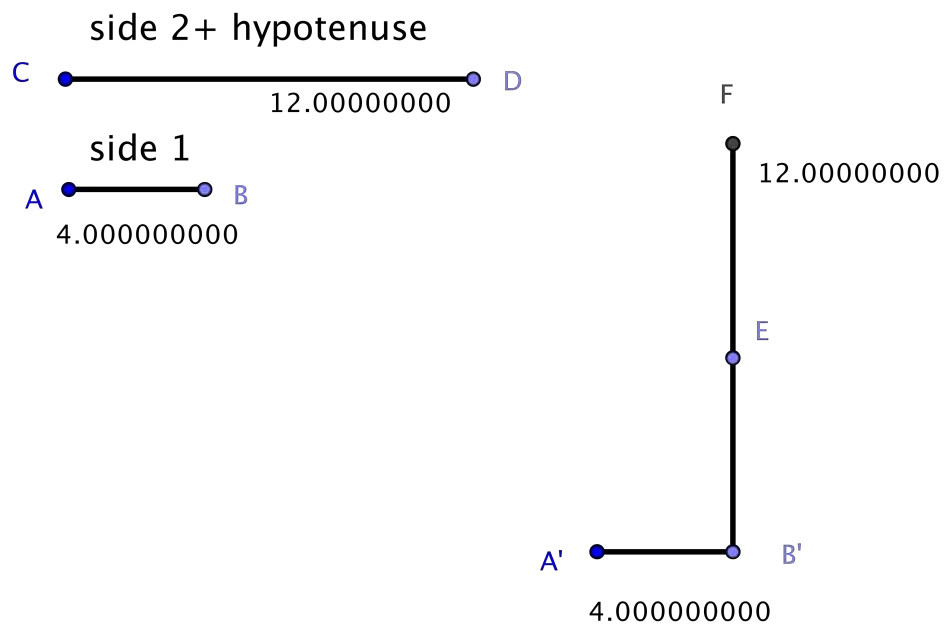
The problem’s data



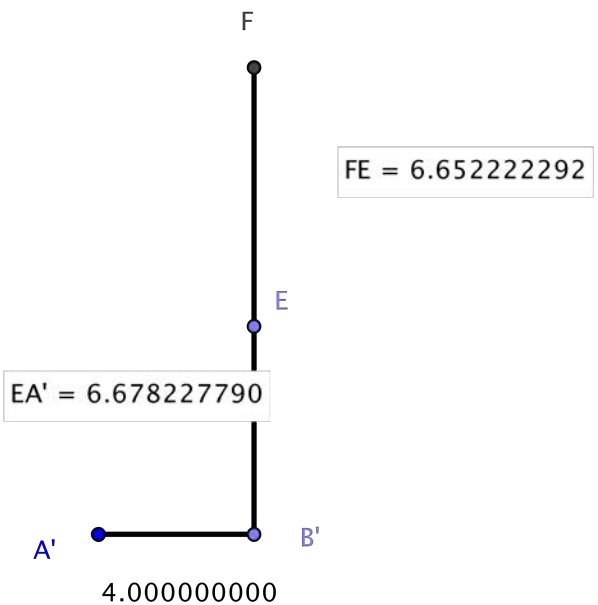
How could be natural to rearrange our data?



In order to construct the right-angled triangle, we have to cut the upright segment in a point E that allows F to overlap to A’ with a rotation around E. In other words EA’=EF

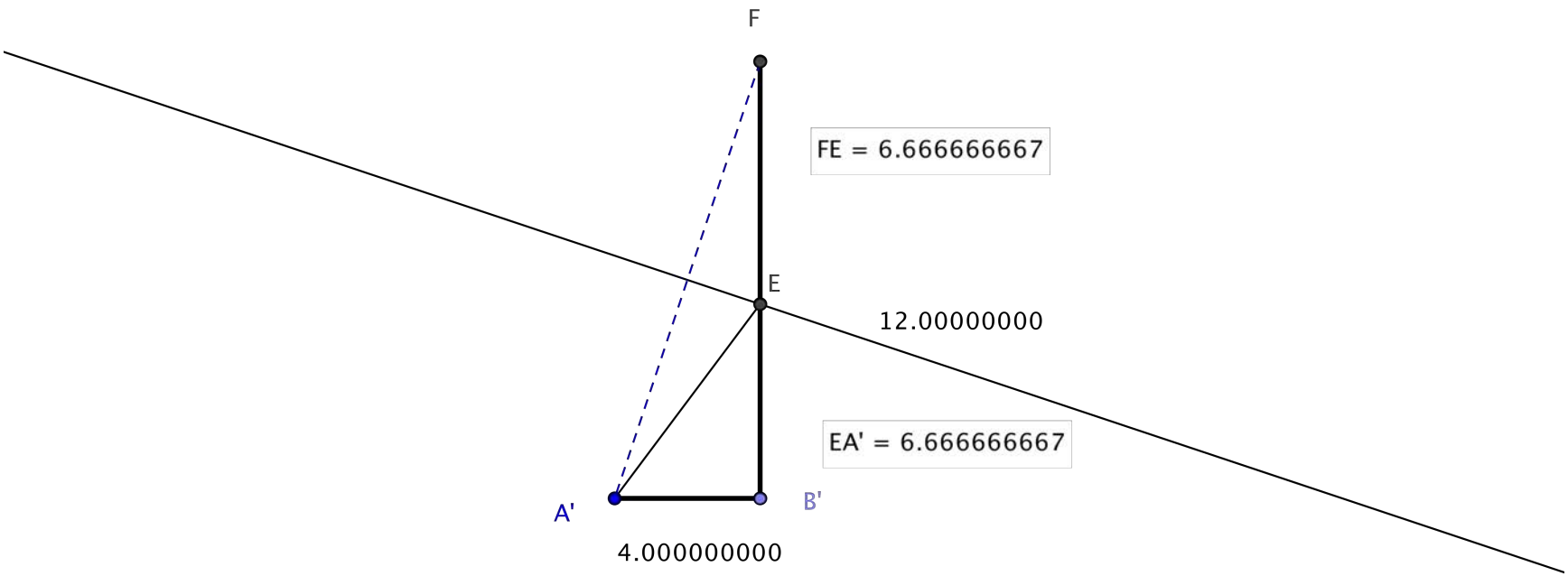


We could try to satisfy the request EA'=EF by measuring the segments and dragging E. We could do pretty well but, we'll never reach the equality.



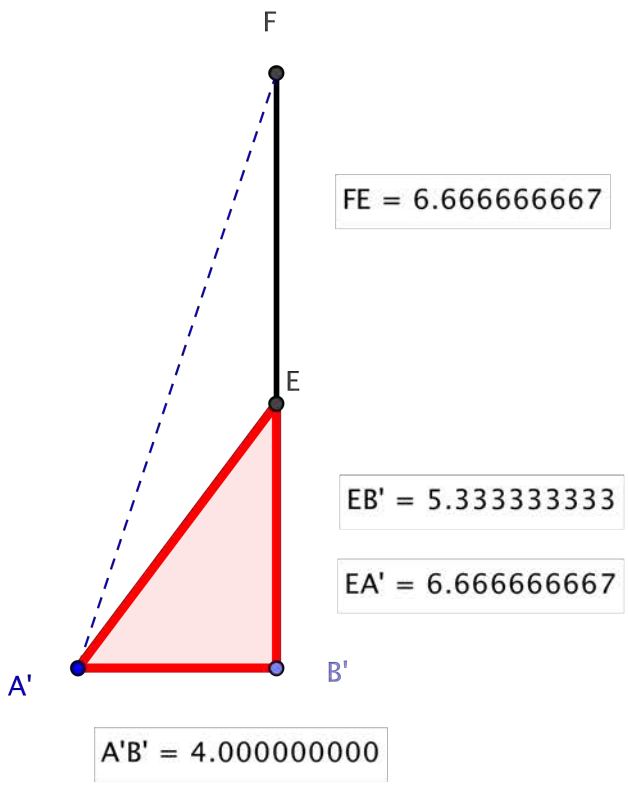
So, what could we do?

The tool of the perpendicular bisector, i.e. the line perpendicular to a segment and passing through its midpoint, is a possible answer.



Each point lying on the perpendicular bisector of FA’ has the same distance from both F and A’.

Our results:
Side 1= 4, Side 2=16/3, Hypotenuse=20/3



The same results as the equation's

Geogebra's Geometry View commands for costructing the right-angled triangle

- Segment with given length, Segment
- Perpendicular line;
- Circle with center and radius;
- Show/Hide Object, Show/Hide Label;
- Point, Point on an object;
- Distance or length;
- Perpendicular bisector;
- Polygon.