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Unit Title: History of Mathematics: An interactive journey from the past to the present.

Topic: History of Mathematics

Language: English

Language Level **B1** / **B2**

Target students: Secondary school (ages from 16years)

Time: 3-4 hours

Aims:

- to improve their language competence, by learning and using new words in English, concerning Maths terminology like golden intersection, (mathematical) proof, segment, irrational, rational, e.t.c.;
- to be informed about the most significant historical facts and Mathematical figures as well as their achievements from the ancient times until today;
- take an active role in understanding the function of Pythagoras' "cup of justice" and the Golden Intersection, experiencing in that way the Ancient Greeks' mathematical knowledge and way of thinking;
- to introduce a way of organizing team work in the classroom and involving students in the learning process so that every student will be engaged in the process and be able to take initiative, while enhancing social skills and gaining new knowledge;
- to acquire knowledge of numbers, measures and structures, basic operations and mathematical presentations and an understanding of mathematical terms and concepts;
- to develop creative thinking.

Final product: A presentation of each group's conclusions of an activity about the "Golden Intersection".





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Methodology, classroom activities:

- teacher's speech
- group work
- multimedia

(laptops, projector, power point presentations, tape measures, Pythagoras' cup)

Assessment tools: Conversation. Feedback.

Documents and materials : presentation, papers for taking notes or notepads.

Description of activities

Students work	Methods and resources	Assessment
First part : History of Mathematics		
<p>The students are informed about the most significant historical facts and Mathematical figures as well as their achievements from the ancient times until today.</p>	<p>Teacher's speech</p>	<p>Some students faced difficulties with the Mathematical terms but they all found the speech very interesting and asked many questions. But they were also asked questions like "did you enjoy the process", "did you learn something new", "did you come across any problems...which ones" etc.</p>
Second part : Pythagoras' cup and the Golden Intersection		
<p>The students take an active role in understanding the function of Pythagoras' "cup of justice" and the Golden Intersection. Each student is given a copy of Pythagoras' cup and they are asked to fill it with water over the marked line inside the cup. They realize then that the water is pouring out of a hole at the bottom of the cup. The whole idea refers to the limits people should have in their lives- even in drinking!- which complies with the</p>		<p>The students participate in these activities, listening to music during the second's part presentation. They work with their group members, asking questions, calculating, measuring and comprehended a part of the ancient Greeks' philosophy. They also find out how beauty</p>



Students work	Methods and resources	Assessment
<p>content of ancient Greek philosophy «moderation is best (<i>μέτρον ἄριστον</i>).</p> <p>The students are also given a tape measure to count the distance from their nose to the top of their head, from the chin to their nose, from their elbows to the beginning of their palms and so on...The write down all these numbers and by using mathematical types they get an average for each one of them. The ones that reach the Golden Intersection are thought to be more beautiful (~1,62).</p>	<p>Group work</p> <p>https://www.geogebra.org/</p>	<p>in nature and Mathematics are related. They are also asked questions like “how well did you cooperate with your fellow students”, “did you fully understand the tasks”, “how difficult or easy was it for you to express your opinion in a foreign language”, “did you enjoy the process”, “did you learn something new”, “did you come across any problems...which ones” etc.</p>

WORKSHEETS

Worksheet 1

1. Build groups of three students. Write down 10 words/expressions associated with the History of Mathematics.

word/ expression	Translation

2. Write down 10 sentences associated with Mathematics and the unit “Pythagoras’ cup”.

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Worksheet 2: Listen to the following presentation and write down unknown words in a word list.

word/ expression	meaning in my language



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1. Search for the meaning of the words in wordbook or translate with your mobile. Save your result on a flip chart paper. Ask the lecturers the questions occurring during the presentation.
2. Present your results shortly in front of the audience.

Unit Title: Meeting points of a line and a parabola and the car crash accident activity

Topic: Relative positions of a line and a parabola on the Euclidean plane and their meeting points

Language: English

Language Level B1 / B2

Target students: Secondary school (ages from 16years)

Time: 2 hours

Aims:

- to learn and use new words in English, concerning Maths terminology like determinant, abscissa, parabola, equation, graphic representation, e.t.c.;
- to learn how to use Geogebra (a free Maths software) which connects Geometry with Algebra;
- to comprehend:
 - o the connection between the algebraic equation of a line and a parabola and their graphic representations.
 - o the relation of the solutions of the equation (formed by the line and the parabola) and their meeting points.
 - o the reason why the abscissas of the meeting points of the line and the parabola are the solutions of the quadratic equation;
- to implement the knowledge obtained by the geogebra activity (including a worksheet) to the main course's task which was the car crash accident activity;
- to cooperate successfully with peers.





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Final product: A presentation of each group's conclusions concerning the two activities mentioned above.

Methodology, classroom activities:

- teacher's speech
- group work
- pairwork
- individual activities
- multimedia

(laptops, projector, power point presentations, geogebra software)

Assessment tools: Conversation, back.

Documents and materials: Powerpoint presentation, worksheets.

Description of activities

Students work	Methods and resources	Assessment
First hour : Activity's implementation		
Talking about the concept of the functions and its graph.	Teacher's speech	Many students don't clearly understand the language and the math terminology and others cannot remember basic math concepts so that the intervention from the teacher is necessary.
Getting a grasp of Geogebra.	Individual activity, pair activity, group work.	
Working on worksheet 1 – using Geogebra, experimenting, investigating, observing, noticing, searching, finding connections and relations, discussing, justifying answers, resolving questions.	Group work Worksheet 1: the activity	The students find it difficult to comprehend some relations, mostly algebraic but they understand easier the graphic representations.



Students work	Methods and resources	Assessment
	The teacher helps when needed, providing scaffolding strategies.	.
Writing conclusions, sharing of the results.	Class activity	Feedback, Conversation.
Second hour : Task's implementation		
Working on worksheet 2 – Using the knowledge obtained from the previous activity the students calculate, investigate and adjust the outcomes of the first hour to the data of the task, justifying their answers.	Group work Worksheet 2: the task The teacher helps when needed, providing scaffolding strategies.	Feedback
Checking their answers using Geogebra, writing conclusions, sharing of the results.	Class activity	

WORKSHEETS

Worksheet 1

Activity: Meeting points of a line and a parabola

A. Open the geogebra file [meeting points of a line and a parabola+solutions.ggb](#)

B. The parabola $y = ax^2$ and the line $y = bx + c$ are given, where the sliders a , b and c can change their graphic representations when different values are set.

C1. Experiment giving various values to the slides a , b and c and observe the meeting points of the line and the parabola. Write down your conclusions.

C2. What happens specifically, when:

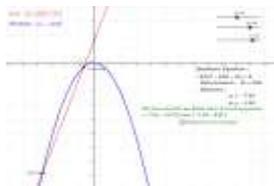
- i. $a = -0.5$, $b = 3$, $c = 4$ ii. $a = -0.4$, $b = -1.2$, $c = 0.9$ iii.
 $a = -1$, $b = 4$, $c = 5$

D. Notice the quadratic equation and its determinant that emerge each time you change the values of the sliders. Can you understand how this equation is formed?

E. What's the connection between the -equation and its determinant- and the meeting points of - the line and the parabola-? Justify your answers and click the square to check them.

F. Notice the solutions of the equation (when $D \geq 0$) and the abscissas of the meeting points. Explain why this is happening.

G. Write your conclusions concerning the connection between the determinant of the equation and the meeting points (and their abscissas) of the line and the parabola.



A figure of the activity

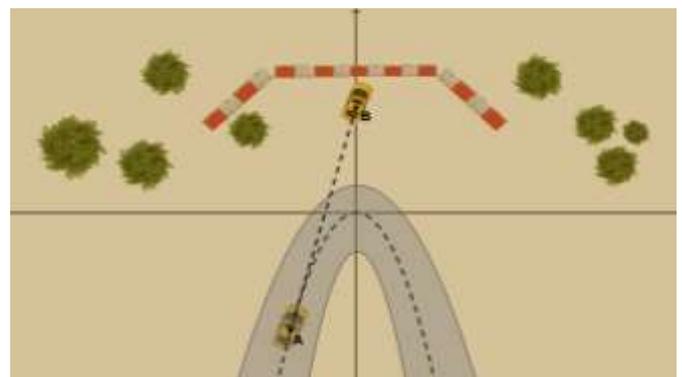
Worksheet 2

Task: The car crash accident

A car is moving on a road and its orbit

is given by the parabola $C : y = -x^2$.

At a later time, the car goes off its course at the point A with abscissa





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$x_1 = -2$. It continues moving straight

ahead and hits the barriers as shown

at the next figure. Using the conclusions

of the previous activity,

i. Calculate the ordinate of the point A

where the car went off its course.

ii. Find the equation of the rectilinear

orbit from A to B.

iii. Calculate the coordinates of the

hitting point B.

iv. In the road lies a hole at the point with coordinates $(-1.5, -1)$. Will the car fall in

the hole during its course? Justify all your answers.

You can also check your answers with Geogebra.