Association **THE YOUNG MATHEMATICIAN** VRNJACKA BANJA
www.mladimatematicar.org
E-mail: mladimatematicar@gmail.com
Phone numbers: +38165-800-2669, +38163-183-2669

# The "Mathematics Bridge" Quiz

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| Title | **"Mathematics Bridge" Quiz** |
| The name of the Organizers | **"Young Mathematician"**<br><br>Address: Olimpijska 1, Vrnjačka Banja<br><br>TIN: 107273855<br><br>Company Number: 28062117<br><br>Website: http://www.mladimatematicar.org<br><br>email: mladimatematicar@gmail.com |
| Name and surname of the person responsible | **Radica Karović**<br>phone number: 063-183-26-69<br>mladimatematicar@gmail.com |
| Time and place | Schools organize teams and report them to the Central Commission of Quizzes, which then schedules the competition.<br><br>The quiz pre quarter-final (the school competition) will be held on January 24, 2020. (host school)<br><br>The quiz quarter-final (municipal competition) will be held on March 14, 2020. (host school)<br><br>The quiz semifinal (regional competition) will be held on April 25, 2020. (host school)<br><br>The quiz final (state) and international competition will be held on May 22-24, 2020, in Vrnjačka Banja. |
| Quiz authors: | **PhD Đorđe Baralić**, research associate, Mathematical Institute of the Serbian Academy of Sciences and Arts in Belgrade (Geometry Challenge)<br>**Mg Tatjana Stanković,** mathematics professor, the school of electrical engineering "Nikola Tesla" in Pančevo (Mathematical Labyrinth, Mathematical Bouquet) |

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| | **Radica Karović, a** mathematics professor in the "Oslobodioci Beograda" primary school in Belgrade (Mathematical Labyrinth, Mathematical Riddles, the Project) |

## The Idea Behind the "Mathematics Bridge" Quiz

The idea of the "Mathematics Bridge" quiz is to promote mathematics and its applications to different real-life problems, as well as develop cross-subject competences. The "Mathematics Bridge" is based on the constructivist learning theory, where students actively construct and create their own knowledge. It is characterized by an innovative approach that works together with the newest study plans and programs for regular class time.

The quiz consists of the following games:

1. Mathematical riddles
2. Geometry challenge
3. The Project
4. Mathematical bouquet

## The Goals of the "Mathematics Bridge" Quiz

**The primary goals of the "Mathematics Bridge" quiz:**

- The affirmation of the educational work, student accomplishments, and raising the quality of education;
- The improvement of teaching mathematics and related subjects in the contemporary technological environment, as well as the popularization of mathematics.

**The specific goals of the "Mathematics Bridge" quiz**

- The modernization of primary school education
  - Introducing and perfecting working with new tools, in an environment of information and communicative technologies;
  - The development of project-based learning, the education method of the 21st century;

- The development of cooperative and collaborative learning in the face of new technology;

- Linking mathematics with problems in other sciences, as well as real-life problems, with special reference to art and culture:
- Mathematical modeling in education;
- The development of communication and cooperation skills between teachers, students, and non-teaching staff;
- The development and nurturing of science and science culture, in a sense of the way it relates to mathematics.

## The Tasks of the "Mathematics Bridge" Quiz

- Evaluating the levels of acquired knowledge, capabilities, skills, and competences among students;
- Evaluating student creativity, as well as the way they display the results of their work publicly, as a part of their project assignment;
- Ranking the students based on their level of accomplishment.

## Target Audience

- High school students whose weekly mathematics teaching hours do not exceed 3 classes
- High school students whose weekly mathematics teaching hours amount to 4 or more classes
- Students of schools for the education of students with disabilities
- The professors of mathematics, informatics, and related vocational subjects in high schools.

## The Levels of the "Mathematics Bridge" Quiz and Their Organization

The quiz levels are as follows: school, municipal, regional, state, and international.

**Pre quarter-final** quiz (the school competition) is a mandatory level, except when the number of students who applied is less than five. It's organized by the expert council of the school mathematicians, or the expert council of the homeroom teachers, who also make the test. On this level of the competition, the mathematical bouquet and the project assignment are not mandatory.

**Quarter-final** quiz (the municipal competition) is organized by the "Young Mathematician" Association, cooperating with the municipal expert councils of mathematicians, or the expert council of the homeroom teachers. The Central Commission is responsible for test creation. The "Young Mathematician" Association elects the members of the Central Commission and delivers their decision to the person responsible in the school hosting the competition.

**Quiz semifinal** (the regional competition) is organized by the "Young Mathematician" Association, cooperating with the regional expert councils of mathematicians, or the expert council of the homeroom teachers. The semifinal is also organized in a collaboration with the Ministry of Education, Science, and Technological Development (the Ministry). The Central Commission is responsible for test creation. The "Young Mathematician" Association elects the members of the Central Commission and delivers their decision to the person responsible in the school hosting the competition.

**Quiz Final** (the state and/or international competition) is organized by the "Young Mathematician" Association, cooperating with the corresponding Ministry and/or a suitable international organization.

When it comes to organizing the competition, the following persons and institutions are responsible: the competition organizer (The Organization Board of the "Young Mathematician" Association), and:

- the school principal and the representatives of the above-mentioned expert councils on the school level;
- the school principal and the representatives of the above-mentioned expert councils on the municipal level;
- the school principal and the representatives of the above-mentioned expert councils on the regional level;
- the president of the "Young Mathematician" Association, and in the case of international competition, suitable international representatives of the Quiz Final (the state and/or international level).

The Quiz Final consists of two parts:

- "The Project"– in this part of the competition, participants include the schools the Central Commission invited, based on the presented results and the filed documentation for the "Project".

- „The Knowledge Quiz"- only the teams that have won the largest number of points in the semifinal can participate (the total number of points in all the games of the "Mathematics Bridge" quiz).

## The Means of Preparation for the Quiz for Teachers and Students

The preparation of teachers and students for the competition is conducted via the "Young Mathematician" website (www.mladimatematicar.org.rs), as well as during the lectures and workshops for teachers and students organized by the quiz authors and the participants of former competitions.

## The Propositions of the "Mathematics Bridge" Quiz

The quiz is divided into categories, and every educational institution participant is allowed to send **a single team** for **each category**:

1. In the case of high school students with weekly mathematics teaching hours that do not exceed 3

lectures, the team consists of 4 students, one from every year (one first year student, one second year student, one third year student, and one fourth year student). These students can have different weekly teaching hours in mathematics, but the number is not allowed to exceed 3 classes per week. If the school does not have a group of students on their fourth of third year whose weekly teaching hours do not exceed 3 classes, the team is formed in the following manner:

- In case a team consists of students who come from professional schools with three-year courses, the team consists of 4 students: one student from the first year, one student from the second year, and two students from the third year.
- In case a team consists of students who come from professional schools with two-year courses, the team consists of 4 students: one student from the first year, and three students from the second year.

2. There are also high school students whose weekly teaching hours amount to 4 or 5 classes. In this case, the team consists of 4 students, one from every year (one student from the first year, one student from the second year, one student from the third year, and one student from the fourth year). These students can have a varying number of weekly mathematics teaching hours, but this number is not allowed to amount to less than 4 classes per week.

## The "Mathematics Bridge" Quiz for High School Students

The "Mathematics Bridge" Quiz for High School Students consists of four games:

1. Mathematical riddles

2. Geometry Challenge

3. The Project

4. Mathematical bouquet

### Mathematical Riddles

The game consists of four rounds. In each round, there are two tasks (questions).

The first task is the "think fast and deduce" type of question. The participant is expected to solve it within 30 seconds, and the correct answer is worth 4 points. The contender of the suitable grade needs to solve this task individually, that is, they are not allowed to cooperate with other teammates. In the first round, the first task is solved exclusively by all the first-year team contenders, the second round is meant for second-year students, the third round is solved by the third-year students, and the fourth round challenge belongs to fourth-year students.

In the first round, only the first-year contenders solve the first task, in the second round, the second round the second-year students, in the third round, the third-year students, and in the fourth round,

the fourth/third-year students. **There are no negative points in this game. The maximum number of points per round is 10, that is 40 per team.**

**The Geometry Challenge**

The geometry challenge is a "Mathematics Bridge" game that encourages visualization, abstract thinking, and a sense of geometric terms. The goal of this game is to get the students and a wider audience familiar with abstract concepts in a fun way, as well as to make geometry more popular with the wider public as an important and applicable discipline of mathematics. The idea of this game is to spark interest in competition participants and the audience, and get them to do their own research, and want to spend more time thinking about films that illustrate mathematical phenomena.

The teams will get a chance to see a short film or a clip illustrating a geometric object they should observe carefully. While presenting the game, that is the clip, the presenter should communicate the mathematical contents of the clip, that is the basic data and interesting facts about the object in question.

Then, the quiz presenter poses four series of questions about the mathematical features

Then, the quiz presenter poses four series of questions about the mathematical features of the object shown in the film. The first series of questions should be solved by fifth graders, the second by sixth graders, the third by seventh graders, and the fourth by eighth graders (in the case of primary school quizzes). In the case of secondary school quizzes, the first series of questions are meant for first-year students, the second for second-year students, the third for third-year students, and the fourth for fourth-year students. The questions are designed to test the understanding of geometric concepts previously covered in school: geometric shapes, angles, symmetry, etc.

Each series has 3 questions, and every subsequent series of questions has increasingly complex and demanding questions. The correct answer to every question is worth 4 points.

The first question is answered only by the students of a suitable grade, and no consultations with other teammates is allowed. The contenders have 30 seconds to answer the first question.

The second question can be answered by any team member while working together with other teammates. The contenders have 60 seconds to answer this question.

**The maximum number of points a team can win in this game is 32 (in each series the team can score a maximum of 8 points). There are no negative points in this game.**

**The Project**

Along with their mentors, the students work on a project on topic assigned by the "Young Mathematician" Association. Each team has 5 minutes to present their project. Before presenting the project, the team is required to deliver written documentation within the arranged time frame, including:
***Basic information on the first page:**

1. project name
2. project authors (the student's name, surname, and grade)
3. the mentor's name, surname, vocation, and email address.

4. precise school name: the school's address; email address; phone number

The information should be presented in a table, like in the example below:
**Page one**

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| 1. | Project Name | For example: The Flower--- Pythagoras' tree,.... |
| 2. | Names and surnames of all participants, all four of them | |
| 3. | School name and address | |
| 4. | Name and surname of the teacher who ran the project | |
| 5. | Additional information the Commission should know about the project | |

***Project description on page two:**
The project description must contain the following features:
**1. Project goal**
**2. Project plan**
**3. The elaboration of the project**
**4. Project implementation**
**5. Project presentation**
**6. Reflections on the project**

The maximum number of points for the project description is 1-15.

7. **Mathematical terms** - list three general terms at most that cover the entire project, and explain it in detail (proof), including the sources (theorems - proof related to mathematical terms). For example: Geometric objects in a plane (implies, a point, a line, a circle, transformations…) Function (linear, algebraic expressions ...) The possible number of points is 1-15, but there are also negative points, ranging from -10 to 0 points.

The participants get negative points in case they make a mistake and/or name terms which are not listed, and/or for terms with origins that have not been listed.

8. **Software tools** -list all tools used in any part of the project, as well as the way they were used (proof). The possible number of points the participants can get is 1-15, but there are also negative points, ranging from -10 to 0 points.

The participants get negative points in case they make a mistake and/or name terms which are not listed, and/or for terms with origins that have not been listed.

**9. Original contribution:**
Theoretical or graphical, or models. 0-30.

The project description, mathematical terms, and software tools are graded separately, that is individually, separate from the Presentation. These points are added to the points the team wins while presenting the project.

**It is necessary for every team to deliver a project Description and a list of mathematical terms and software tools they used, no later than 7 days before the competition starts in electronic form, and right before the competition starts in printed form.**

The written documentation can be delivered on 5 to 7 pages, but keep in mind that pages 6 and 7 can only contain photographs. The writing rules are as follows: a Times New Roman font size 12, margins (down, up, left, right) 1, and a 1,5 line spacing.

**The maximum number of points teams can win is 90.**

**Project description 15 points;**
**Mathematical terms 15 points;**
**Software tools 15 points;**
**Project presentation (on the day of the competition, every jury member assigns a maximum of 5 points) 15 points**
**Original contribution 30 points.**

Using copyright is necessary for photographs, music, and similar.

**The work of the Commission grading the Project:**

The Central Commission controls the validity of the delivered documentation, meeting deadlines, and using copyright. They read the documentation, and track changes from the moment the project is sent, to the final presentation - they keep an eye for the deviations from the initial idea, and decide on the number of points on every level of the competition (Project description, Mathematical terms, and Software tools).

The Central Commission delivers their decision on the final number of points with a short elaboration in writing, to the jury, at the competition. Following the end of the project presentation, the jury decides on the number of points for the Presentation on the spot (a maximum of 15 points). The jury opens the envelope with the number of points, and the comment of the Central Commission, announces the final results, and presents them in a table.

**The projects should be developed in stages, according to the competition level:**

- **Quarter-final competition:** in some of the electronic forms, present the idea, draft of the model, the implementation dynamics, activities, the participants, and the way they presented the Mathematical terms and the Software tools they will be using during Project realization.
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- **-Semifinal competition:** 90% of the project should be finished without significant deviations, and one should do a presentation to confirm that the project was realized according to the required dynamics. Explain the ways Mathematical terms and Software tools are used.
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- -**Final competition:** should deliver the final presentation of a finished project, including a conversation with the Commission (project defense), display the complete documentation.

## Mathematical bouquet

The mathematical bouquet is a game inspired by the game of Association. The Mathematical bouquet game is started by the first team to answer the question presented by the jury president correctly.

The game is resumed by teams in the order of reporting for word. The mathematical bouquet consists of 4 flowers and one bow. Each flower has 4 petals marked with numbers 1 to 4 and a central yellow part (circle). The bouquet also has 8 green leaves (two flowers each).

Each flower is assigned 4 questions, so the total number of questions is 16.

Each question is from a specific grade material and is answered by a member of the appropriate grade team (for example, if the question is intended for a first-year student, only a first-year student can answer it).

Each team opens one petal per round at most. If a participant answers the question correctly, the team gets 2 points, and the term behind the petal is revealed. If the answer is wrong, the team doesn't get any points, and the term behind the petal is not revealed.

Based on the discovered terms (petals) the team guesses the term hiding in the central part (in the yellow circle) and if the team guesses correctly, it is worth 3 points.

In order for a team to be able to guess the term hiding in the central part (the yellow circle), it is necessary to answer correctly to the question hiding behind the petal, in that round.

Based on open terms (petals and/or yellow circles) the team can get a chance to guess the main term hidden in the bow. If all the terms are discovered, the team that guesses the main term gets 10 points.

If not all terms are discovered, in case a team guesses the main term, they get 10 points and the sum of the points carried by the undiscovered fields (petals and central parts - yellow circles). The green leaves in the bouquet serve as clues to help guess the main term (the bow).

You can only get a chance to open the green leaves once all questions for all petals of all flowers have been exhausted.

Every team has the right to open one green leaf per round, at most.

In the case when all the questions have been exhausted, and/or all the clues hidden behind green leaves, and the teams still do not know the final answer to the mathematical bouquet (the red bow), all teams will get a chance to try and guess the unrevealed term in turn.

**The right to an appeal and the deadline for making it**

All members of teams and their mentors have the right to make an appeal immediately after every question in the game, and at the end of presenting the project assignment.
The Commission considers the appeal and announces their decision right after the appeal has been made (if need be, the Commission can consult the members of the Central Commission).
The appeal is made orally.
All appeals made later on can be filed to the Competition Organization Board.

**The Applications for the "Mathematics Bridge" Quiz** will be submitted online, via the "Young Mathematician" Association website: http://www.mladimatematicar.org