

## JANUS : LEARN MATHEMATICS ONLINE!

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«JANUS » is a training program in mathematics for schoolchildren (8-11 class), worked out by Vadim Shagin (Higher School of Economics, Moscow).

Distance learning program «JANUS» (<http://yanus.net.ua>) is designed to teach schoolchildren at a higher level of educational process and works in two modes: a) self-learning mode, and b) mode of joint teacher - pupils work.

Keywords: distance learning, elementary mathematics, financial mathematics

If you are a pupil, the program will help you to prepare for the exam, and to raise your level of knowledge of the subject. Training program «JANUS» has the original algorithm , which is able to eliminate the knowledge gaps. The program itself will guide pupils, taking into consideration their weak points.

If you're a teacher, you will be able to explain your pupils how to learn faster and better. And they will be happy to do their homework on the computer. You do not need to check their papers - you will monitor pupils work through a computer log that program creates automatically at your request. Submitted variants of tasks of different complexity (and their solutions) are used for conducting tests and examinations.

Distinctive features of «JANUS »:

The program is interactive - it leads pupils in the subject and selects the problems most critical for them. Both correct and incorrect solutions are stored by the system and can be used while repeating the curriculum.

When addressing the problems, the system each time creates a problem with new data so that a pupil cannot "get used" to the problem situation and guess the answer. Each reference to the problem will require a new solution.

The system is aimed at pupils and teachers, facilitating both parties in the learning process.

Program functions by connecting via the Internet that protects it from unauthorized copying.

User-friendly interface (the ability to "spy" solution to a similar problem and turn to the right chapters in a textbook) leads to better understanding of the subject (from practice - to theory).

This program includes four modes:



The first three modes are mostly for pupils but teachers also can use it, the last mode is only for teachers. In the mode of exam teachers and pupils come in different ways: teachers prepare the examination material, and pupils take an examination on the problems given to them.

In our system the problem, as the object of learning is something more global than the problem that you used to see in a textbook. The text of the problem consists of the constant part of - an immutable text, and a variable part - it is a formula (equation, inequality, numbers, etc.) with variable coefficients. Coefficients are formed in accordance with the given algorithm by random-number generator, and will change each time you generate the problem. Thus, one and the same problem, generated twice or on different computers will look different and have completely different answers.

Problem can be represented in the form of a test or a number. The test form suggests choice of the one right answer out of four. Numerical form suggests answer as decimal fraction. Some problems might be presented only in a test form, while others- only in numerical form. At the same time, there are problems that might be represented in both forms. In such problems, one can choose the form of representation by switching in the upper right corner of the page displaying the problem. The display format can be set globally, while choosing topics or problems, as well as preparing of the exam material by the teacher. (Then, the priority will be selected form mapping problems.)

In solving any problems teachers and pupils will face with the concept of the rating task. What is it? Rating task - is the level of knowledge of the given problem that show your pupils. When they have accumulated experience in solving problems of a theme or a variety of topics, you can test them using the test mode. In forming of test the system takes into account the ratings tasks. The lower the rating task, the more frequent this problem will occur in the test. Thus, the system itself is set to teach pupils, identify their weak spots and work over. If a pupil study with a teacher in accordance with our program, the later includes him in the group and keeps tracking of all rating tasks in the group journal. Thus, the teacher will always see all weak spots and help to eliminate the gaps in the knowledge of the group.

### Training Mode

In training mode you can select the section and subsection of the topics that you are interested in.

**YANUS**

Main Terms of Use **Choose Mode** Price Preparatory courses About Company Contacts Exit

**Choose topic:**

- Algebra
  - Identical transformations of algebraic expressions**
  - Algebraic equations and inequalities
    - Rational equation
      - Linear and quadratic equations** ←
      - Entire rational equation. Multiplier expansion
      - Entire rational equation. Substitution method
      - Rational-fractional equations
    - Irrational equations
    - Equations with modules
  - System equations
    - Linear system equations
    - Viet's type systems
    - Irrational system of equations
  - Text Tasks
    - Movement
    - Work
    - Mixtures

**Training Mode**  
Task Format

test  
 numeric

Following the link you get to the mode of problem selection of different difficulty levels. And finally, you get to the window where you can see the problem solution.

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Tasks for levels of complexity, indicating your personal rating:

**Theme: Linear and quadratic equations**

Level A		Level B			
Task	R	Task	R	Task	R
<u>1</u>	9	<u>1</u>	3	<u>7</u>	4
<u>2</u>	2	<u>2</u>	0		
<u>3</u>	5	<u>3</u>	4		
<u>4</u>	1	<u>4</u>	2		
<u>5</u>	1	<u>5</u>	7		
<u>6</u>	1	<u>6</u>	0		

On the screen you see the text of the problem as a test, where only one answer out of four is correct.

Generate task

Task complexity level: lev.A

Rating Tasks (in database): 9  
Rating Tasks (in session): 0

If one of the roots of a quadratic equation  $-6x^2+29x+c = 0$  is  $-5$ , the second root is

A	B	C	D
1/6	59/6	-59/6	-1/6

Choose the correct answer:

A     B     C     D

Confirm choice

[Show an example of solving a similar problem](#)    [Theory Link](#)

To solve this problem you need to choose one answer and press button "confirm". The system will notify you if you solved the problem or not. You can solve this problem over and over again by clicking the button to generate a problem. "Each time you'll see the same problem, but with different input data. Accordingly, the answers will also be different. For this reason it will be useless to remember the correct answers. If a pupil needs an example to solve the problem, he will have to click on the link "Show an example of solving the problem," and explanation will follow.

[Hide example of solving similar problems](#)    [Theory Link](#)

One of the roots of a quadratic equation  $5x^2 - 9x + a = 0$  is 4. Find the second root.

Solution. By Vieta's theorem:  $4 + x_2 = \frac{9}{5} \Leftrightarrow x_2 = \frac{9}{5} - 4 = -\frac{11}{5}$ .

If the material is completely unfamiliar, the reference to the "Theory Link" will help:

Vieta's formulas applied to quadratic and cubic polynomial:

For the second degree polynomial (quadratic)  $P(x) = ax^2 + bx + c$ , roots  $x_1, x_2$  of the equation  $P(x) = 0$  satisfy

$$x_1 + x_2 = -\frac{b}{a}, \quad x_1x_2 = \frac{c}{a}.$$

**The top right of the problem** you see data on its ranking in the session and in the database. Let us discuss this in more detail. Rating task - this is the level of knowledge of this problem that show your pupils. It is formed as follows. When you enter into some kind of problem the first time, your score for this problem is zero. In the case of the correct solution at the first attempt rating task increases by 1, and in case of incorrect decisions - reduces by 1. You can generate a problem many times and each correct solution will increase the rating by 1, and incorrect, accordingly, reduce by 1. In this way rating task in the session. will be formed. You'll see it on your screen. When you are out of the given problem, its rating in the

session will be kept in the database. Next time, when you are back to the problem your ranking in the session will be zero, and the rating in the database will be saved from the previous session. Thus, the rating of more than 5 means that you learned to solve this problem. In the context of the problems can be used tables and graphs:

Generate task

Task complexity level: lev.C

Rating Tasks (in database): 4  
Rating Tasks (in session): 0

For the function represented on graphic  $y = a|x-1|+b|x-m|+cx$  to define parameters  $a, b, c$  и  $m$ . In reply to write down a remain from dividing by 4 numbers  $[3a-2b-3c-3m]$ .

A	B	C	D
0	1	2	3

Choose the correct answer:

A    B    C    D

### Testing Mode

Test mode is designed for pupils to check up knowledge on their own when they reach a certain level of training of some topic or set of topics. When using this mode they get to a page where they have to choose topics for testing. Each selected topic should contain the number of problems of one (or more) levels of difficulty. The system will select for pupils problems from the chosen topics, taking into consideration their ratings tasks. The lower the rating task, the more frequent it will occur in the test. Thus, the system itself is set to teach, identify weak spots and train pupils.

Select the partitions for testing, and then specify the number of tasks of each group selected partition. Number of tasks section shall not exceed the allowable maximum, shown on the right of number.

**Test mode**  
**Task Format**

test  
 numeric

**Algebra**

Identical transformations of algebraic expressions

Algebraic equations and inequalities

Rational equation

Linear and quadratic equations  Gr.A: 2 6 Gr.B: 1 7 Gr.C: 0 0

Entire rational equation. Multiplier expansion  Gr.A: 0 1 Gr.B: 3 4 Gr.C: 0 3

Entire rational equation. Substitution method  Gr.A: 0 2 Gr.B: 0 2 Gr.C: 1 1

Rational-fractional equations  Gr.A: 2 5 Gr.B: 0 3 Gr.C: 0 0

Irrational equations

Equations with modules  Gr.A: 0 1 Gr.B: 1 6 Gr.C: 0 0

After the selection of problems is made, it remains to click "Generate a test." **You find yourself** in a window of the test. There are a few presets that will help to bring the test to the regime of the exam, as much as possible. Each problem can be estimated in points depending on the level of complexity. You can specify them yourself or leave the default value. Besides, there is an opportunity to test on time or without taking time into account. The first option is

to fix time for solving of each problem (depending on the level of complexity) or save the data by default.

So everything is ready for the test. You can press the "Test" button. There are problems of the selected sections.

<b>Task №1( Linear and quadratic equations, A06 )</b>				Rating Tasks (in database): 0
Task complexity level: lev.A				
Solve the equation $4x^2+24x+39=0$				
A	B	C	D	
-3;3/4	1/2;	3;-3/4	∅	
Choose the correct answer:				
<input type="radio"/> A	<input type="radio"/> B	<input type="radio"/> C	<input type="radio"/> D	
<b>Task №2( Rational-fractional equations, A04 )</b>				Rating Tasks (in database): 0
Task complexity level: lev.A				
Solve the equation $\frac{-4}{-3x-3} = \frac{3}{4x+5}$				
A	B	C	D	
-7/11	-11/7	11/7	29/25	
Choose the correct answer:				
<input type="radio"/> A	<input type="radio"/> B	<input type="radio"/> C	<input type="radio"/> D	
<b>Task №3( Linear and quadratic equations, B06 )</b>				Rating Tasks (in database): 0
Task complexity level: lev.B				
Lets $x_1$ и $x_2$ - the roots of a quadratic equation $3x^2-4x+1=0$ .				
Write the given quadratic equation $x^2+bx+c=0$				
with roots $-x_1-2x_2$ и $-2x_1-x_2$ . In reply write number $4b-4c$ .				
A	B	C	D	

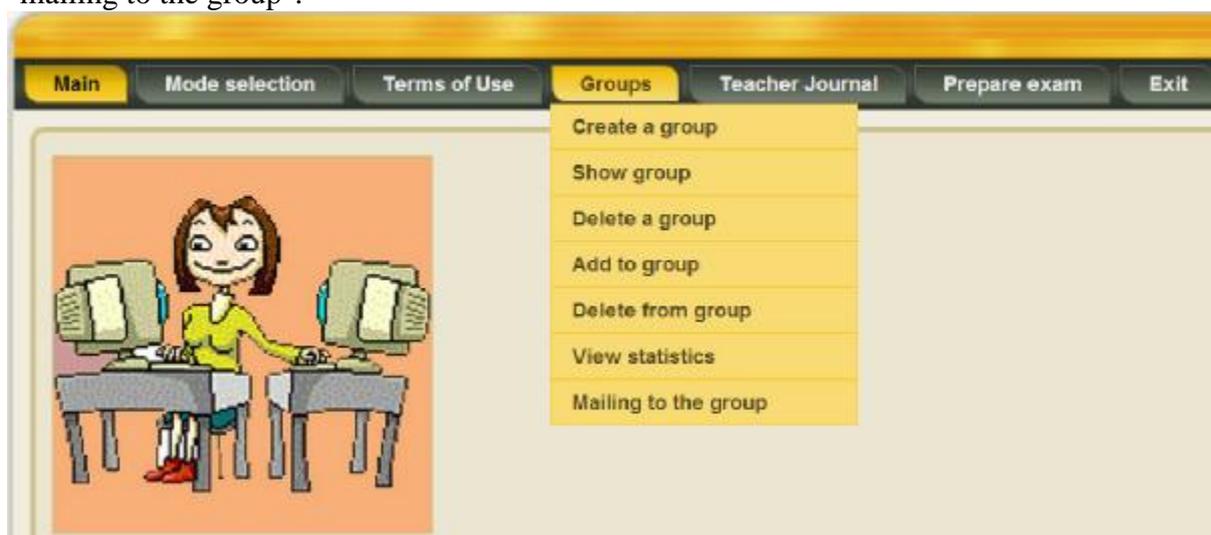
The test results appear in the Scorecard:

The results of the test:			
Task №	Result	Maximum # of points	Scoring points
1	+	1	1
2	+	1	1
3	-	2	0
4	-	2	0
5	+	2	2
6	+	2	2
7	-	2	0
8	+	2	2

**Your scores = 8 out of 14 is 57%**

### The Teacher's Room Mode

This mode is designed for teachers. It allows you to recruit your own class (group) or several classes (groups) of pupils and monitor their learning process. To do this, go to the menu "group" and select one of his points: "a group" (if necessary you can delete the new group using the menu item "delete group"). Once the group has been created, you can add a group of your pupils, but first they should be registered in the system. To achieve this, two points were foreseen in menu: "add to the group" and, accordingly, "remove from the group". If you want to add pupils, you must know their username in the system or email address, which are registered in the system. There is one more point in menu of the "group" - "View Statistics" where teachers can view statistics for all pupils in their groups. They can send letters to all pupils of the group or individually selected pupils by choosing menu point "mailing to the group".



The most convenient and familiar way for teachers to work with the group of pupils - a class journal. For this purpose, a special menu item "journal" in which teachers can view the

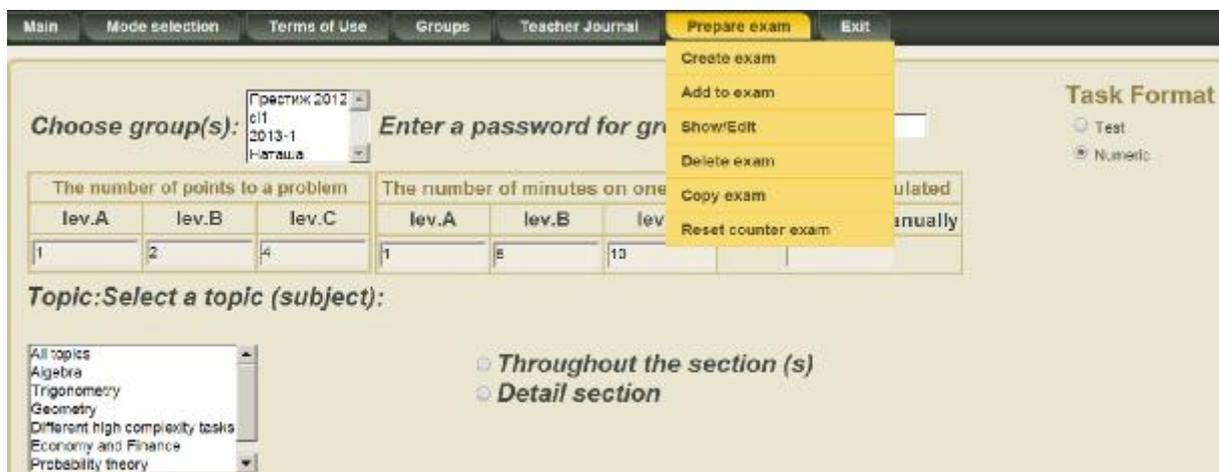
results of a pupil work or group as a whole, on each problem, topic, or all topics of the subject.

**Group - 2013-1. Theme - Linear and quadratic equations**

Surname	A01	A02	A03	A04	A05	A06	B01	B02	B03	B04	B05	B06	B07
АЗОВ	5	5	5	5	5	5	5	5	2	0	0	0	1
БРУТЯН	4	4	3	4	4	3	4	3	4	3	4	4	4
ДИСКИН	0	4	0	4	4	4	0	0	0	0	0	0	4
ЛИ	6	4	4	4	4	4	4	4	4	11	4	4	4
ТИХОНОВА	4	4	4	4	4	4	4	4	2	1	1	1	1

When a teacher gives one problem for the whole group of pupils to work at home or in class, everyone will have to solve it with his data and on his own computer, thus pupils will not be able to copy off the correct answer from each other. Computer, instead of a teacher, will check up pupils exercise books and place an assessment (rating tasks) for the work done by every pupil. Taking into consideration the assessment results, mentioned above, a teacher will be able to concentrate on elimination of knowledge gaps in the group of pupils.

This mode of operation in the classroom allows the teacher to determine how available, he outlined the theoretical material. One has only to give the whole class a practical problem on a new topic, and he can instantly see the percentage of pupils understanding of the material. And if it turns out that this understanding at the level of 50% or even less, the teacher will have to represent the material in accessible form.



The system JANUS we tried as much as possible to cover all stages of training and aims to facilitate this process as much as possible for both: pupils and teachers.

The system allows different content items from any field of knowledge (economics, physics, foreign languages, history, etc.).

And if you wish to advance the program with your own interesting ideas - we are eager to consider your suggestions and incorporate them into the appropriate section. Thus, the training program "JANUS " is constantly updated and improved.