The Government of the Russian Federation

The Federal State Autonomous Institution of Higher Education "National Research University - Higher School of Economics"

National Research University «Higher School of Economics»

Faculty of Information Technology and Computer Engineering
Department of Computer Systems and Networks

Course title: Network computing

Practical training Extra practice.

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1.) Goal (цель): practice solving: a cos(x) + b sin(x) = c
2). Variant: (вариант): no number.

3). Listings and figures.
Figure 1.1:

FindRoot.java

```
1
2  class FindRoot {
3
4      public static void main(String[] args) {
5          // Параметры уравнения:
6          double a=5;
7          double b=3;
8          double c=1;
9          // Вспомогательная переменная:
10         double alpha;
11         // Логическая переменная - критерий наличия решений:
12         boolean state;
13         // Значение вспомогательной переменной:
14         alpha=Math.asin(a/Math.sqrt(a*a+b*b));
15         // Вычисление критерия:
16         state=a*a+b*b>=c*c;
17         // Вывод на экран значений исходных параметров:
18         System.out.println("Уравнение a*cos(x)+b*sin(x)=c");
19         System.out.println("Параметры:");
20         System.out.println("a="+a);
21         System.out.println("b="+b);
22         System.out.println("c="+c);
23         System.out.print("Решение для x: ");
24         // Вычисление решения уравнения и вывод на экран:
25         System.out.println(state?Math.asin(c/Math.sqrt(a*a+b*b))-alpha:"решений нет!");
26         }
27     }
28
```

Problems @ Javadoc Declaration Console

```
<terminated> FindRoot [Java Application] C:\Program Files\Java\jdk-12.0.1\bin\javaw.exe (5 июн. 2019 г., 16:18:14)
Уравнение a*cos(x)+b*sin(x)=c
Параметры:
a=5.0
b=3.0
c=1.0
Решение для x: -0.8580262366249893
```

Listing 1.2:

```
class FindRoot {

	public static void main(String[] args) {
		// Параметры уравнения:
		double a=5;
		double b=3;
		double c=1;
		// Вспомогательная переменная:
		double alpha;
		// Логическая переменная - критерий наличия решений:
		boolean state;
		// Значение вспомогательной переменной:
		alpha=Math.asin(a/Math.sqrt(a*a+b*b));
		// Вычисление критерия:
		state=a*a+b*b>=c*c;
		// Вывод на экран значений исходных параметров:
		System.out.println("Уравнение a*cos(x)+b*sin(x)=c");
		System.out.println("Параметры:");
		System.out.println("a="+a);
		System.out.println("b="+b);
		System.out.println("c="+c);
		System.out.print("Решение для x: ");
		// Вычисление решения уравнения и вывод на экран:
		System.out.println(state?Math.asin(c/Math.sqrt(a*a+b*b))-alpha:"решений
нет!");
		}
	}
```

3). Explanations:

$$a\cos(x) + b\sin(x) = c\,.$$

$$\sin(x+\alpha) = \frac{c}{\sqrt{a^2+b^2}},$$

$$\sin(\alpha) = \frac{a}{\sqrt{a^2+b^2}}\,.$$

$$x = -\arcsin\left(\frac{a}{\sqrt{a^2+b^2}}\right) + (-1)^n \arcsin\left(\frac{c}{\sqrt{a^2+b^2}}\right) + \pi n\,.$$

$$x = \arcsin\left(\frac{c}{\sqrt{a^2+b^2}}\right) - \arcsin\left(\frac{a}{\sqrt{a^2+b^2}}\right).$$

The main place in the program is the use of the ternary operator in the last command to display the values for the root of the equation. Previously displayed reference information about the values of the parameters of the equation. In the last output command, the argument of the println () method contains an expression: state? Math.asin (c / Math.sqrt (a * a + b * b)) - alpha: "no solutions!" This is the result of the calculation of the ternary operator, the verifiable condition in which the logical variable state is specified. Previously, the value of this variable is assigned by the state = a * a + b * b> = c * c command. The variable value is true if the equation has solutions, and false if it does not. If the state variable is true, the ternary operator returns the numerical value Math.asin (c / Math.sqrt (a * a + b * b)) - alpha as the result, where the alpha variable is previously used with the command alpha = Math. asin (a / math.sqrt (a * a + b * b)) is assigned a value. These expressions use the built-in functions asin () and sqrt () to calculate the arc sine and square root. Thus, for the true first operand of the ternary operator, the solution of the equation returned as a value. If the value of the first operand of the ternary operator (state variable) is false, the text "no solutions!" returned as the result. Although for different values of the first operand, values of different types are returned, since the whole structure is indicated by the argument of the println () method due to automatic type conversion, in both cases the result is converted to text format.

References:

- Projects’ files
- LMS materials