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TEACHING STUDENTS TO SOLVE TRIGONOMETRIC EQUATIONS USING ELEMENTS OF MATHEMATICAL ANALYSIS IN MATHEMATICS CIRCLES

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A B S T R A C T	K E Y W O R D S
Mathematics circles, mathematics is the main type of work outside the classroom. Circles arouse students' interest in science and improve their mathematical thinking, skills, and the quality of their mathematical training. This increases students' thinking range.	

Introduction

There are the following methods of using elements of mathematical analysis in solving trigonometric equations.

1. Using the field of definition of the function
2. Use of the property of boundedness of the function
3. Using properties of sine and cosine functions
4. Avoiding numerical inequalities.

1. Using the field of definition of the function

1. Example $\sqrt{|\sin x|} = \sqrt[4]{-|\sin x|} + tgx$ Solve equation (1).

Solving. The field of definition of Eq

$$\begin{cases} |\sin x| \ge 0 \\ -|\sin x| \ge 0 \\ x \ne \dfrac{\pi}{2} + \pi n; \quad n \in z \end{cases}$$

consists of

From this $x = \pi k, \ \ k \in z$. x Putting this value of in equation (1), we see that its right and left sides are equal to 0. So everyone $x = \pi k; \ \ k \in z$ will be the root of the equation. J: $x = \pi k; \ \ k \in z$.

2. Use of the property of boundedness of the function

Example 2. $\cos^2(x \sin x) = 1 + \log_5^2 \sqrt{x^2 + x + 1}$ Solve equation (2).

Solution: the equation is defined for all real X's. For an arbitrary X

$\cos^2(x\sin x) \le 1, \quad 1+\log_5^2\sqrt{x^2+x+1} \ge 1$

As a result, equation (2) is equivalent to the following system of equations.

$$\begin{cases} \cos^2(x\sin x) = 1 \\ \log_5^2\sqrt{x^2+x+1} = 0 \end{cases}$$

the general solution x=0 follows from this system. Answer: x=0

Example 3. Solve the equation.

$$2\cos^2\frac{x^2+x}{6} = \log_5(5+x) + \frac{1}{\log_5(5+x)}$$

Eat: $e(y)$ according to

$$\begin{cases} 2\cos^2\frac{x^2+x}{6} \le 2 \\ \log_5(5+x) + \frac{1}{\log_5(5+x)} \ge 2 \end{cases} \Rightarrow \begin{cases} 2\cos^2\frac{x^2+x}{6} = 2 \\ \log_5(5+x) + \frac{1}{\log_5(5+x)} = 2 \end{cases} \Rightarrow x = 0$$

it follows that

Answer: x=0

3. Using properties of sine and cosine functions

Example 4 $\cos^3 3x + \cos^{11} 7x = -2$ solve the equation.

Solution: If x_0 is a solution of the equation, then $\cos 3x_0 = -1$

(otherwise $\cos 7x_0 < -1$ it cannot be). So, $\cos 7x_0 = -1$

As a result, the arbitrary solution of the equation will be the solution of the following system.

$$\begin{cases} \cos 3x = -1 \\ \cos 7x = -1 \end{cases}$$

arbitrary solution of the system is the solution of the equation. Therefore, the equation is as strong as the above system. The first equation of the system $x_k = \frac{\pi}{3} + \frac{2\pi k}{3}, \quad k \in z$ has a solution.

From these solutions, we find the ones that satisfy the system equation 2. These satisfy the following equality $m \in z$ are numbers.

$\frac{7\pi}{3} + \frac{14\pi k}{3} = \pi + 2\pi m$ we write in the following form: $k = \frac{3m-2}{7}$

Equality since K and M are integers $m = 7t+3, \quad t \in z$ is appropriate, but in this $k = 3t+1, \quad t \in z$

So, this is the solution of the system x_k that $k = 3t+1, \quad t \in z.$

$$x = \frac{\pi}{3} + 2\pi t + \frac{2\pi}{3}, \quad t \in z$$

So the general answer is: $x = \pi + 2\pi t, \quad t \in z$

4. Avoiding numerical inequalities.

Example 5. $\left(\frac{1}{\sin^8 x}+\frac{1}{\cos^2 2x}\right)\left(\sin^8 x+\cos^2 2x\right)=4\cos^2\sqrt{\frac{\pi^2}{4}-x^2}$ solve the equation.Solution: For arbitrary positive numbers and $\left(\frac{1}{a}+\frac{1}{b}\right)(a+b)\geq 4$

we know that inequality is reasonable. In the field of definition of Eq $\sin^8 x>0,\quad \cos^2 2x>0$ using the inequality, we see that the left side of the equation is not less than 4. At the same time, in the field of definition of Eq $0\leq\cos^2\sqrt{\frac{\pi^2}{4}-x^2}\leq 4$

As a result, the equation is equivalent to the following system of equations.

$$\begin{cases}\left(\frac{1}{\sin^8 x}+\frac{1}{\cos^2 2x}\right)\left(\sin^8 x+\cos^2 2x\right)=4\\ \cos^2\sqrt{\frac{\pi^2}{4}-x^2}=1\end{cases}$$

So, $x_1=\frac{\pi}{2}$ and $x_2=-\frac{\pi}{2}$ will be the solutions of the given equation.

List of Used Literature

1. И.Х. Сивашинский «Элементарные функции и графики» Москва. "Наука" 1968г.[95,134]
2. T. Karimov, K. To'raqulov. S. Abdullayev. "Maktabda tenglama va tengsizliklar" Toshkent. "O'qituvchi", 1992 yil.[54,86]
3. Turg'inov A.M, Asqaraliyeva M.A Matematika to'garaklarida o'quvchilarga ba'zi tenglamalarni tenglamalar sistemasiga keltirib echishni o'rgatish.
4. Turginov Azizjon Mamasaliyevich, Asqaraliyeva Muktasarkxon Azizjon kizi A non –local problem for a third-order equation with multiple chrarasteristics Vol.42,Issue-05,2022 pp.230-241
5. Тургинов А.М., Асқаралиева М.А. об одной нелокальной задаче для уравнения третьего порядка с нелокальным условиям. IJSSIR, Vol. 11, No. 06. June 2022, с 66-73.