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ENHANCING STUDENTS' INTEREST IN MATHEMATICS LEARNING THROUGH WAYGROUND-ASSISTED GAME-BASED LEARNING

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ABSTRACT

Many students in senior high school still perceive mathematics as a difficult and unengaging subject, resulting in low learning interest that hinders their active participation in the learning process. This study aims to examine the effect of Wayground-assisted game-based learning on students' learning interest in mathematics, specifically on the Three-Variable Linear Equation Systems (TVLES) topic among Grade X senior high school students. This study employed a quantitative approach with a quasi-experimental method and a non-equivalent control group design. The sample consisted of 28 students in the experimental class (X Ibnu Sina) and 28 students in the control class (X Ibnu Hayyan). Questionnaires and documentation were used to gather data. A learning interest questionnaire comprising measures of enjoyment, attractiveness, focus, and active participation was the instrument utilized. Data were analyzed using descriptive statistics, normality test, homogeneity test, and independent sample t-test. The results showed that the experimental class's mean score increased from 54.25 to 62.36, while the control class's mean score decreased from 58.79 to 56.46. The hypothesis test yielded a significance value of 0.001 ($p < 0.05$), indicating that Wayground-assisted game-based learning significantly affected students' learning interest in mathematics. These findings suggest that Wayground can serve as an effective and engaging digital learning medium to enhance students' learning interest in mathematics, making it a promising alternative to conventional teaching approaches.

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1. INTRODUCTION

Education is essentially a learning system composed of several interrelated components including learning objectives, instructional materials, teaching methods, and learning media that must work together to achieve the intended educational goals (Darsyah, 2023).These components must work together cohesively, as the absence of any single component can reduce the overall effectiveness of the learning process.

Mathematics is one of the subjects essential to the development of logical thinking abilities, supporting students' comprehension of ideas, problem-solving skills, and practical application of thinking (Baidowi et al., 2019). This is particularly relevant to topics such as Three-Variable Linear Equation Systems (TVLES), which require students to construct mathematical models, perform systematic calculations, and apply logical reasoning to find consistent solutions. Despite its importance, Indonesian students' mathematics performance remains a persistent concern: the 2022 Programme for International Student Assessment (PISA) reported that Indonesian 15-year-old students scored an average of 366 points in mathematics, well below the OECD average of 472, with only 18% reaching at least a minimum proficiency level (OECD, 2023). This low achievement is consistent with the perception among many students that mathematics is a difficult and uninteresting subject, which in turn contributes to their lack of enthusiasm in learning mathematics, including on TVLES topics that demand sustained conceptual engagement.

One of the mathematical subjects taught in Grade X of senior high school is Three-Variable Linear Equation Systems (TVLES). It calls for conceptual comprehension, precise computation, and logical and methodical thinking abilities. Learning is still hampered by students' inability to solve mathematical problems related to TVLES; prior research found that students made various errors when solving TVLES problems, including errors in reading, comprehending, and transforming the problem, as well as in carrying out the solution process (Kuswanti & Nusantara, 2018).Prior research has also demonstrated that learning techniques are required to motivate students to investigate, assess, and offer rational explanations while resolving TVLES problems (Dahliahi & Asmara, 2026),however, this study did not specifically examine learning media that could simultaneously increase students' enthusiasm and active engagement during the learning process. Additional research has found that pupils continue to struggle with comprehending mathematical ideas and adjusting to different types of TVLES challenges (Meylinda & Solahudin, 2025), yet it has not explored interactive, technology-based approaches as a potential solution to this persistent difficulty. These gaps indicate the need for game-based learning media, such as Wayground, that can make TVLES more engaging while directly addressing students' conceptual and motivational barriers.

The low level of student interest in learning suggests that more creative and engaging teaching methods are required. Game-based learning (GBL) has been identified as one promising approach: it incorporates appealing and entertaining qualities that facilitate content comprehension, reduce student boredom during class, and foster creative thinking in mathematics learning (Maulidina et al., 2018; Muhtarom et al., 2022; Nurdin et al., 2024; Nurhikmah et al., 2024).

One game-based learning platform applicable in this context is Wayground. Wayground is an educational software that integrates multiplayer activities into classroom instruction, offering challenges, quizzes, leaderboard elements, and score systems to create an engaging and dynamic learning environment (Andy et al., 2023) . Its interactive features have been shown to enhance students' understanding of mathematics and increase their participation in learning activities (Khairina et al., 2025).

Several studies have examined the use of Wayground in educational settings and reported positive outcomes. Kurniawan et al., (2024) and Yuliani, (2024) found that Wayground increased students' learning interest, though their studies focused on subjects other than mathematics. Dhuha et al., (2024) examined the effect of Wayground-assisted game-based learning on both learning interest and mathematics proficiency simultaneously, without isolating learning interest as the primary dependent variable. Setiawan et al., (2019) investigated Wayground in the context of TVLES material but focused specifically on students' procedural process skills rather than their learning interest. These studies collectively demonstrate Wayground's potential as a learning medium; however, none has specifically examined the effect of Wayground-assisted game-based learning on students' learning interest in mathematics within the TVLES topic at the senior high school level. This study therefore addresses that gap by providing empirical evidence on Wayground's role in enhancing learning interest in a context that has not been previously investigated.

Preliminary observations at SMA IT Al-Izzah indicated that students tended to be inactive during mathematics classes and exhibited little enthusiasm in the learning process. Students were easily bored with learning activities that relied primarily on discussion and question-and-answer sessions, and found it challenging to solve TVLES problems when question forms deviated from the teacher's examples. These conditions highlight the need for an innovative learning medium capable of increasing student motivation and engagement specifically on TVLES material.

Based on the context described above, this study raises the following research question: Does Wayground-assisted game-based learning significantly affect Grade X senior high school students' interest in learning mathematics on the Three-Variable Linear Equation Systems (TVLES) topic? It is hypothesized that students taught using Wayground-assisted game-based learning will demonstrate significantly higher learning interest compared to those taught using conventional instruction

2. METHOD

This study used a quantitative approach with a quasi-experimental design, specifically a non-equivalent control group design (Sugiyono, 2019). An experimental class and a control class were the two groups included in the investigation, allowing the researcher to examine the effect of the treatment without random assignment of students, since the groups followed pre-existing classroom compositions. While the control group got traditional training, the experimental group was taught utilizing Wayground-assisted game-based learning.

The study was carried out in the second semester of the 2025–2026 school year at SMA Swasta Islam Terpadu (SMAS IT) Al-Izzah Batubara. All of the school's tenth-graders made up the population. Class X Ibnu Hayyan served as the control group and Class X Ibnu Sina as the experimental group in the study sample. Purposive sampling was the method employed (Sugiyono, 2019).

Table 1. Research Design

Class	Pretest	Treatment	Posttest
Experiment	O_1	X	O_2
Control	O_3	–	O_4

Where:
O_1 = Pretest of the experimental group
O_2 = Posttest of the experimental group

O_3 = Pretest of the control group
O_4 = Posttest of the control group
X = Learning through Wayground-assisted Game-Based Learning

A mathematics learning interest questionnaire and documentation made up the research tools. A four-point Likert scale strongly agree, agree, disagree, and strongly disagree was used in the questionnaire. Enjoyment, attractiveness, focus, and active participation in mathematics education were the measures of learning interest (Mayrhofer et al., 2025). The questionnaire consisted of [items distributed across these four indicators, with example items such as 'I feel happy when learning mathematics' (enjoyment indicator) and 'I pay close attention during mathematics lessons' (focus indicator). The instrument was developed by the researcher based on the indicators above, adapted to the context of the research setting. Supporting data was gathered through documentation, including student statistics and pictures of educational events."

The instruments underwent validity and reliability testing prior to administration. An item was considered valid if its Corrected Item-Total Correlation coefficient exceeded the minimum threshold of 0.30. With coefficients ranging from 0.392 to 0.663, all items in the questionnaire exceeded this threshold and were therefore deemed valid. Additionally, the Cronbach's Alpha score is 0.901, which falls into the very high reliability category. As a result, every questionnaire item was deemed consistent and suitable for the study.

To collect data, pretest and posttest questionnaires were distributed to both groups. The data was statistically examined using both descriptive and inferential statistics. The analytical methods included homogeneity testing, normality testing, and hypothesis testing utilizing the Independent Samples t-test at a significance level of 0.05 using SPSS software. The Independent Samples t-test was selected because the study compared the mean learning interest scores of two independent groups (the experimental and control classes) whose data satisfied the parametric assumptions of normal distribution and homogeneity of variance. The hypothesis decision was made by comparing the resulting significance value (p) against the 0.05 significance level: if $p < 0.05$, the null hypothesis (H_0) was rejected and the alternative hypothesis (H_1) was accepted, indicating a significant difference between the two groups; if $p \geq 0.05$, H_0 was retained, indicating no significant difference

Three primary phases comprised the research process: planning, execution, and completion. These stages were carried out systematically to ensure that the collected data were accurate and aligned with the research objectives.The researcher created learning resources and research tools, such as test items and a learning interest questionnaire, during the planning phase. The experimental and control classes were chosen as research samples after instrument validity and reliability tests were carried out.

To ascertain the beginning circumstances of the pupils, a pretest in the form of a learning interest questionnaire was administered to both classrooms during the implementation stage. Different educational strategies were then used. While the control group got traditional education, the experimental group was taught utilizing the Game-Based Learning approach. The Wayground program was used in the experimental class to assist learning activities and increase student involvement.

Figure 1.Wayground Application

Wayground offered a variety of interactive exercises to students, such as multiple-choice questions, short tests, and game-based assignments intended to boost engagement and motivation. A posttest was given to both classes after the instructional therapy was finished in order to assess how the intervention affected the students' enthusiasm in learning.

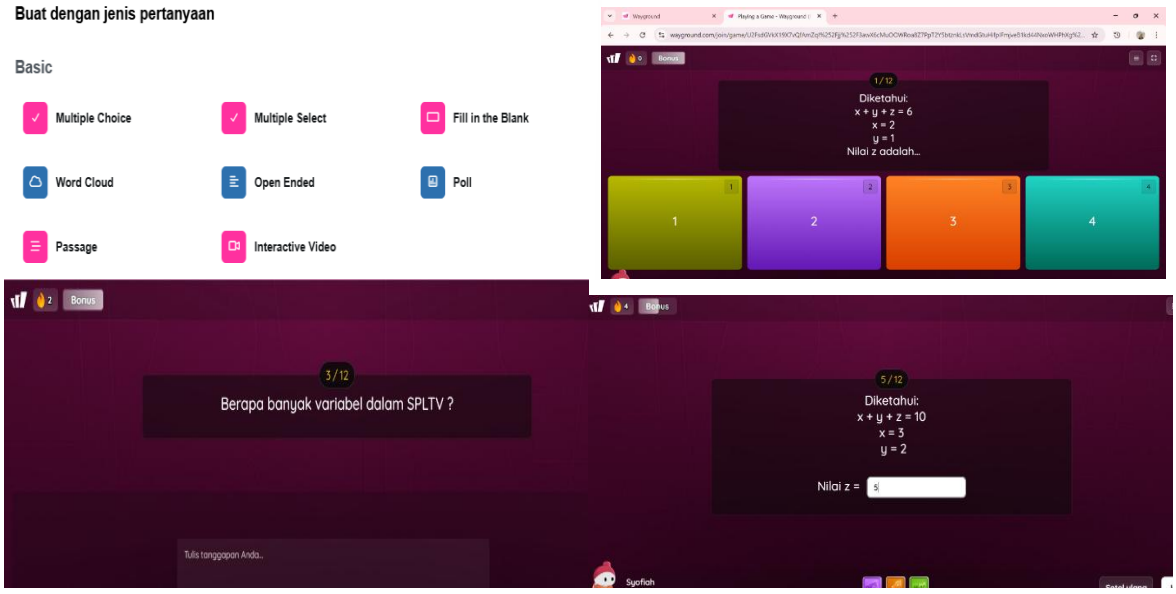

Figure 2.Available Question Format Options in the Wayground Application

The gathered data were then processed and examined using the proper statistical methods in the last phase. The impact of the game-based learning paradigm on students' enthusiasm in learning was then ascertained using hypothesis testing. Conclusions were made based on the analysis's results, and pertinent suggestions were given in line with the study's conclusions.

3. RESULTS AND DISCUSSION

3.1. Results

Students in Grade X participated in the study, which was carried out at SMA Swasta Islam Terpadu Al-Izzah. There were 28 students in each of the experimental class (X Ibnu Sina) and control class (X Ibnu Hayyan). While the control group got traditional training, the experimental group was taught utilizing Wayground-assisted game-based learning.

Figure 3. Conventional Learning in the Control Class

Figure 4.Game-Based Learning in the Experimental Class

Figure 3 shows the learning activities in the control class, where the instructor relied on conventional explanations and class discussions, while students completed individual or group tasks assigned directly by the instructor. As reflected in this figure, learning was largely teacher-centered and focused on content delivery and direct problem-solving, with minimal use of digital learning resources conditions that align with the relatively low and declining learning interest observed in the control group's posttest results.

In contrast, Figure 4 illustrates the experimental class's use of Wayground-assisted game-based learning, where students used laptops to access interactive quizzes featuring leaderboards and real-time scoring. As shown in the figure, students were visibly engaged in friendly competition with peers, actively answering questions and participating in discussions. This visual evidence corresponds with the quantitative findings, in which the experimental class's mean score increased from 54.25 to 62.36, supporting the interpretation that the gamified elements observed in Figure 4 contributed directly to the higher engagement and enthusiasm reflected in the posttest results.

Pretest and posttest questionnaires evaluating students' enthusiasm in learning were given to both courses. Descriptive and inferential statistical methods were then used to evaluate the gathered data.

The mean score of students' learning interest in the experimental class rose from 54.25 (pretest) to 62.36 (posttest), according to the descriptive analysis. Additionally, the experimental class's lower standard deviation number suggests that students' interest in learning improved more uniformly throughout the class as the data got less spread.

Table 2.Descriptive Statistics of Students' Learning Interest

	N	Range	Min	Max	Mean	Std. Deviation	Variance
Pretest experiment	28	28	37	65	54.2500	6.71993	45.157
Posttest Experiment	28	21	54	75	62.3571	5.78769	33.497
Pretest control	28	27	42	69	58.7857	6.70742	44.989
Posttest control	28	26	41	67	56.4643	7.09451	50.332
Valid N (listwise)	28						

The mean score for the control group, on the other hand, dropped from 58.79 to 56.46. This decrease suggests that traditional teaching methods were less successful in sustaining and boosting students' enthusiasm in learning. The two groups' differing growth in learning interest indicates that Wayground-assisted game-based learning was more interesting than traditional learning.

The Shapiro-Wilk test was used to perform the normalcy test. Significance values greater than 0.05 in the findings showed that all of the data were regularly distributed (Sig. > 0.05).

Table 3.Normality Test Results (Shapiro-Wilk)

Class	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Pre-test Control Class	.108	28	.200*	.966	28	.483
Post-test Control Class	.104	28	.200*	.958	28	.305
Pre-test Experimental Class	.109	28	.200*	.957	28	.295
Post-test Experimental Class	.096	28	.200*	.960	28	.357

**. This is a lower bound of the true significance.*

a. Lilliefors Significance Correction

All datasets, including the pretest and posttest scores in the experimental and control groups, had significant values more than 0.05, according to the test results. Specifically, the experimental class had a pretest of 0.295 and a posttest of 0.357, while the control class had a pretest of 0.483 and a posttest of 0.305. These numbers show that there was no discernible departure from a normal distribution in the data. Thus, it can be said that every dataset satisfied the normalcy assumption.

Additionally, Levene's Test homogeneity test revealed that the data were homogenous, with significant values of 0.461 for the posttest and 0.926 for the pretest. The variances of the experimental and control groups were homogenous as both values were higher than 0.05. This finding implies that both groups' levels of data dispersion were comparatively equal.

Table 4. Homogeneity Test Results (Levene's Test)

Data	Sig.
Pretest	0.926
Posttest	0.461

With a computed t-value of −3.406, the hypothesis test using the Independent Samples t-test produced a significance value of 0.001, which was less than the significance level of 0.05. These findings show that there was a statistically significant difference between the experimental group's and the control group's pupils' enthusiasm in learning.

Table 5.Independent Sample t-test Results

		T	**Sig.(2-tailed)**
learning interest	Equal Variances assumed	-3.406	0.001
	Equal Variances not assumed	-3.406	0.001

With a significance value of 0.001 ($p < 0.05$), the Independent Samples t-test revealed a statistically significant difference between the experimental and control groups' enthusiasm in learning mathematics. Consequently, the null hypothesis (H_0) was rejected and the alternative hypothesis (H_1) was validated, suggesting that Wayground-assisted game-based learning significantly increased students' passion for studying mathematics.

3.2. Discussion

According to the study's findings, students who engaged in Wayground-assisted game-based learning and those who got traditional teaching had different levels of enthusiasm in studying mathematics. Both the learning process and the data analysis outcomes made this distinction clear. The results show that using game-based learning materials improved students' enthusiasm in learning.

The descriptive analysis, which revealed that the experimental class's mean score rose from 54.25 in the pretest to 62.36 in the posttest, reflects this outcome. This improvement shows that once game-based learning was introduced, students became more engaged, passionate, and motivated in studying mathematics. The control group, on the other hand, saw a drop in mean score from 58.79 to 56.46 after receiving traditional teaching. This decrease implies that less diversified teaching strategies are often less successful in sustaining students' enthusiasm and involvement in their education. The results indicate that Wayground-assisted game-based learning increased students' enthusiasm in studying mathematics, even if the N-Gain analysis showed a very little gain. According to the study's findings, students who engaged in Wayground-assisted game-based learning showed a markedly different level of enthusiasm in studying mathematics compared to those who received traditional teaching. The descriptive analysis revealed that the experimental class's mean score rose from 54.25 in the pretest to 62.36 in the posttest, while the control group's mean score declined from 58.79 to 56.46. This contrast suggests that conventional, less varied teaching strategies are often less effective in sustaining students' enthusiasm and involvement in learning, whereas the introduction of game-based elements fostered greater engagement, passion, and motivation among students.

These results align with the idea of game-based learning, which highlights the use of game features to increase students' interest, engagement, and focus throughout the learning process. Wayground's interactive tests, point systems, leaderboards, and instant feedback encouraged students to take an active role in their math education. The results of this investigation are validated by Radityastuti et al., (2023), who reported that Digital Game-

Based Learning can increase student engagement in mathematics learning. Furthermore, Dhuha et al., (2024) discovered that students' interest in studying mathematics increased when Quizizz was used to develop game-based learning. Similarly, Rahmaini & Novita, (2018) outlined how using educational technology may make the classroom more dynamic and interesting, which will motivate students to participate in class activities. As a result, the experimental class's increased interest in learning indicates that including gaming aspects into math education might make learning more fun and encourage active student engagement. These descriptive observations can be further explained through motivation theory. According to Self-Determination Theory (Ryan & Deci, 2000), intrinsic motivation flourishes when three basic psychological needs are met: competence, autonomy, and relatedness. Wayground's instant feedback allows students to perceive measurable progress, supporting their sense of competence; the flexibility to engage with quizzes at their own pace supports autonomy; and the leaderboard system fosters social comparison and connectedness with peers, supporting relatedness. In addition, the ARCS Motivation Model (Keller, 1987) helps explain why these features are effective: Wayground captures students' Attention through interactive visuals and game mechanics, builds Confidence through immediate and constructive feedback, and produces Satisfaction through rewards such as points and rankings. Viewed through these frameworks, the leaderboard, quizzes, and feedback are not merely engaging on the surface, but function as mechanisms that directly fulfill psychological needs known to drive sustained motivation and learning engagement.

The Wayground program, which produced a more interesting, fun, and interactive learning environment, had an impact on the experimental class's increased enthusiasm in learning. Students participated more actively in the learning process through interactive tests, practice tasks, and point and leaderboard systems. Students actively participated in educational activities rather than just receiving information. They also showed more attention when tackling difficulties and seemed more eager to ask and respond to inquiries. These circumstances align with the idea of game-based learning, which highlights how fun, challenge, and instant feedback throughout the learning process may boost students' intrinsic motivation when learning activities are presented in a game style.

With a significance value of 0.001 ($p < 0.05$), the Independent Samples t-test results demonstrated a statistically significant difference between the experimental and control groups' enthusiasm to learn mathematics. Consequently, the null hypothesis (H_0) was rejected and the alternative hypothesis (H_1) was validated, suggesting that Wayground-assisted game-based learning significantly increased students' passion for studying mathematics. The game-based learning environment, which gave students the chance to actively participate in answering questions, doing tasks, and getting instant feedback throughout the learning process, is responsible for the increase in learning interest.

These results align with the research that was done by Fatimah et al., (2024), This showed how using game-based learning may boost students' interest in learning by decreasing monotony and providing a more diversified educational experience . Similarly, Arriesty et al (2025) found that employing Quizizz and GeoGebra to create technology-supported learning models increased students' enthusiasm in learning. These results provide more credence to the idea that using games and quizzes in digital media might increase students' enthusiasm for learning mathematics. Students' enthusiasm for learning activities is increased when game components are incorporated, which raises their level of involvement with the mathematics learning process. As a result, Wayground-assisted game-based learning may be regarded as a successful teaching strategy for raising students' motivation to learn mathematics. Although (Radityastuti et al., 2023),(Fatimah et al., 2024), and (Arriesty et al., 2025) employed different platforms ranging from generic Digital Game-Based Learning approaches to Quizizz and GeoGebra their findings converge with the

present study in showing that gamified, technology-assisted instruction consistently enhances students' interest and engagement compared to conventional teaching. The minor variations in effect size across these studies are more plausibly explained by differences in subject matter, intervention duration, and the specific game mechanics emphasized by each platform, rather than by any substantive disagreement regarding the value of game-based learning itself.

However, the N-Gain score classified the improvement seen in this research as modest. The short study period, students' adjustment to technology-based learning materials, and the difficulty of the Three-Variable Linear Equation Systems (TVLES) subject, which calls on analytical and logical thinking abilities, might all have had an impact on this outcome. This study also had a number of drawbacks, such as a limited sample size, inadequate control over outside factors, and research tools that might not have accurately reflected students' skills.In order to get more ideal results and make a bigger contribution to raising the standard of mathematics education and students' interest in learning, it is advised that game-based learning be further developed and refined. This apparent discrepancy between a statistically significant result and a modest N-Gain value can be understood by recognizing that the two measures capture different aspects of the data: statistical significance indicates that the observed difference between groups is unlikely to have occurred by chance, whereas the N-Gain reflects the actual magnitude of improvement relative to the maximum possible gain. Taken together, these results suggest that Wayground-assisted game-based learning produced a real and reliable effect on students' learning interest, but one whose magnitude was constrained by contextual factors such as the brief intervention period and students' limited prior exposure to technology-based learning tools.

These findings carry several practical implications. For teachers, Wayground can be integrated into TVLES instruction by converting routine practice problems into interactive, leaderboard-based quizzes used either to activate prior knowledge at the start of a lesson or to reinforce newly learned concepts at its conclusion. For schools, the results suggest that investing in accessible digital infrastructure, such as stable internet access and adequate devices, can support the broader adoption of game-based learning tools to address persistently low student interest in mathematics. For educational media developers, this study highlights the importance of designing gamification features that are deliberately aligned with established motivational principles—such as those outlined in Self-Determination Theory and the ARCS Model rather than relying on superficial game elements alone, in order to maximize their impact on sustained student engagement

4. CONCLUSION

Based on the study's findings, Wayground-assisted game-based learning had a positive and significant effect on Grade X students' interest in learning mathematics on the Three-Variable Linear Equation Systems (TVLES) topic. Prior to the intervention, students exhibited low enthusiasm, focus, and engagement under conventional teaching methods. Following the implementation of Wayground, students in the experimental class demonstrated greater enthusiasm, attentiveness, and active participation in discussions, question-and-answer sessions, and practice activities.

Although the increase in learning interest was statistically significant, the corresponding N-Gain value remained relatively low. This suggests that while Wayground successfully stimulated short-term engagement and enthusiasm, deeper and more sustained gains in learning interest may require longer implementation periods and further adaptation to students' familiarity with technology-based learning tools.

These findings affirm the potential of Wayground as an effective digital learning medium for mathematics instruction. Specifically, teachers may integrate Wayground into TVLES instruction by transforming routine practice problems into interactive quiz-based competitions, using its real-time leaderboard features to motivate active participation, and embedding game elements within each stage of problem-solving such as forming systems of equations, applying elimination or substitution methods, and verifying solutions—to make abstract algebraic concepts more concrete and engaging.

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