

# Student's Difficulty Identification in Completing the Problem of Equation and Trigonometry Identities

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How to Cite: Rohimah, S.,M., & Prabawanto, S. (2019). Student's Difficulty Identification in Completing the Problem of Equation and Trigonometry Identities. *International Journal of Trends in Mathematics Education Research*, 2(1), 34-36. DOI: <http://dx.doi.org/10.33122/ijtmer.v2i1.50>

## ARTICLE HISTORY

Received: 4 February 2019

Revised: 18 February 2019

Accepted: 28 February 2019

## KEYWORDS

Mathematical Difficulties

Trigonometric Equations

Trigonometric Identities

## ABSTRACT

This study aims to identify the types of difficulties experienced by high school students in solving equations and trigonometric identities. The method used in this research is descriptive qualitative research method because researchers want to describe or describe the facts of students' difficulties in solving equations and trigonometric identities. The data collection technique in this study is by using respondents' ability tests and interviews. Based on the results of data analysis, there are three aspects of students' difficulties in solving trigonometric equations and also there are three aspects of students' difficulties in solving trigonometric identity problems. The difficulties of students in solving trigonometric equations, namely the difficulty of students in deciphering the form of the problem, difficulty in factoring in the form of trigonometric quadratic equations, and difficulties using the basic trigonometric equations. Whereas, the difficulties of students in solving trigonometric identity problems, namely the difficulty of students applying general trigonometry formulas, difficulty describing each of the trigonometric comparison relationships, and difficulties in performing algebraic calculations/computation.

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## 1. INTRODUCTION

Mathematics is a scientific discipline that underlies the development of modern technology which has an important role in advancing human thinking, so that mastering and creating technology in the future requires a strong mastery of mathematics from an early age (BSNP, 2006). An important part in learning mathematics itself is the process of learning mathematics. Jaworksy (in Sulistiawati, 2012; Trisnawati, 2018; Usmadi, 2018) states that the implementation of mathematics learning is not easy because students experience difficulties in learning mathematics. Difficulties in learning mathematics is what causes students to have low abilities in the field of mathematics studies.

One of the material in the field of mathematics study that is studied at the high school level is trigonometry. In learning trigonometry some students often encounter difficulties caused by students' incomprehension in trigonometric concepts. One of the trigonometric material that is considered difficult by students is the similarity and proof of trigonometric identity, because it requires an understanding of the right concepts and high accuracy in their application (Aqilah 2012; Yulandari 2012; Huljannah, Sugita, & Anggraini, 2015; Mustamir, 2019; Wulandari, 2019).

This can be seen from the results of the research of Huljannah, Sugita, & Anggraini, (2015) who conducted identification tests for Al-Azhar High School students with the following question: determine the set of resolutions from  $2 \sin^2 x = -\sin x + 1$ , for  $0^\circ \leq x \leq 360^\circ$ . One of the answers of students who showed

difficulties in answering these questions can be seen in Figure 1 below:

$$\begin{aligned} 2 \sin^2 x &= -\sin x + 1 \\ 2 \sin x^2 &= -\sin x + 1 \\ 2 \sin x^2 + \sin x &= 1 \\ \sin(2x^2 + x) &= 1 \\ \sin &= \frac{1}{2x^2 + x} \end{aligned}$$

In Figure 1 above, the student tends to solve questions using algebra, he has not been able to connect algebraic reasoning with the trigonometric concepts he has learned. NCTM (in Koyunkaya, 2016) emphasizes the importance of trigonometric concepts in connecting algebraic and geometric reasoning. Therefore, if students are unable to connect algebraic reasoning and geometry in learning trigonometry, then they will have difficulty in solving trigonometric problems.

Another difficulty experienced by students in Figure 1 is the difficulty in describing the form of the problem, understanding the angles in trigonometry, and the difficulty of calculating/computing to find a set of solutions. These difficulties if left unchecked will cause low student learning outcomes. Therefore, these difficulties need to

be identified and known for their causes so that the right solution can be chosen for use in classroom learning.

## 2. RESEARCH METHOD

The research method used is descriptive qualitative research method, namely research that describes or describes the object of research based on facts that appear or as they are (Nawawi & Martini, 1996). Qualitative descriptive research seeks to describe all existing symptoms or conditions, namely the state of symptoms according to what they were at the time the research was conducted (Mukhtar, 2013). The subjects of this study were class XII high school students in the city of Bandung who had participated in material learning equations and trigonometric identities. While the object in this study is the identification of student difficulties in solving equations and trigonometric identities.

Data collection techniques in this study were tests of respondents' abilities and interviews. Data obtained by tests is the difficulties experienced by students. The data validity checking technique used is the method triangulation. Triangulation method is done by comparing test results and interview data. Data analysis used refers to the analysis of data according to Miles & Huberman (1992) namely data reduction, data presentation, and conclusion drawing.

## 3. RESULT AND DISCUSSION

The researcher gave a test to class XII students about the material similarity and trigonometric identity consisting of two items, namely: (1) determine the set of resolutions from  $2 \sin^2 x = -\sin x + 1$ , for  $0^\circ \leq x \leq 360^\circ$ , (2) prove that  $\frac{\sec \alpha - \operatorname{cosec} \alpha}{\sec \alpha + \operatorname{cosec} \alpha} = \frac{-1 + \tan \alpha}{1 + \tan \alpha}$ . The test results show the percentage of students who answered correctly number 1 was 18% and the percentage of students who answered correctly number 2 was 36%. The difficulty of students in completing number 1 questions lies in the difficulty of deciphering the form of the problem, factoring in the quadratic trigonometry equation, and difficulty using the basic trigonometric equation solution. Identifying student difficulties in question number 1 is presented in Figure 2 below:

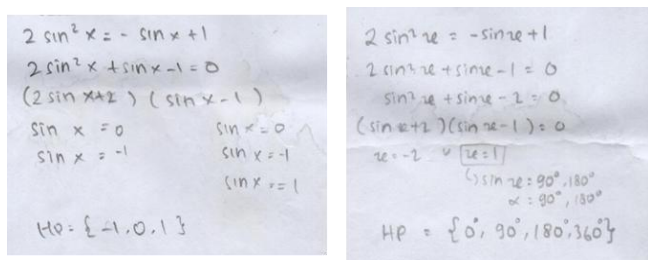


Figure 2. Student Answers to Question Number 1

Based on Figure 2, student A has difficulty in factoring the shape of the trigonometric quadratic equation and the difficulty in determining the  $x$  angle that satisfies the  $\sin x$  equation, it only writes the result of  $\sin x$ , not the value from the  $x$  angle. In contrast to student B, he understood how to look for  $x$  angles but he misconstrued the factoring of the quadratic equation of the trigonometry and the difficulty of using a basic trigonometric equation. After interviews with these students, student A did not understand the trigonometry concept well, he did not understand that looking for the value of  $x$  should be sought using the basic

trigonometric equation, so it is not the result of the value of  $\sin x$ . Instead, student B understood the concept of trigonometry, but he had difficulty in factoring the square of the trigonometry and the difficulty of using the basic trigonometric equation.

In accordance with the results of the study of Chigonga (2016) which states that the trigonometric equation is a material that is difficult to teach and difficult to learn. The difficulty can also be caused because the trigonometric equation material is not liked or not desired by students, so the trigonometric equation material learning becomes more difficult to understand. In addition, many concepts must be mastered by students before learning the trigonometric equation material, for example for the question number 1 above, the concept of reporting quadratic equations must be well-mastered by students.

Furthermore, the difficulty of students in completing question number 2 is located in the difficulty of students applying general trigonometry formulas, difficulties in describing each of the trigonometric comparison relationships, and the difficulty of performing algebraic calculations / computations. Identifying student difficulties in question number 1 is presented in Figure 3 below:

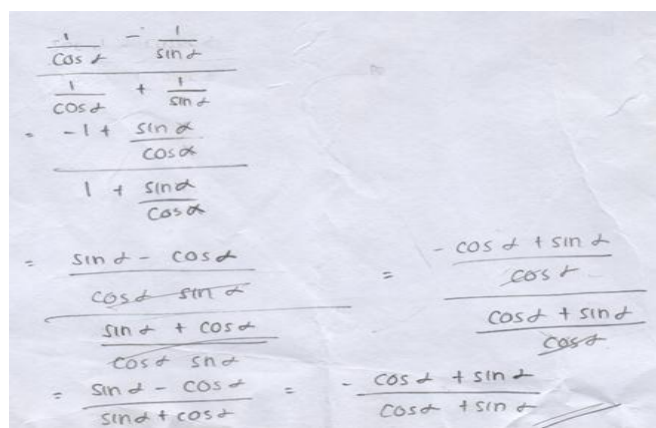


Figure 3. Student Answers to Question Number 2

Based on Figure 3, students have difficulty describing each of the trigonometric comparison relationships, so that achieving trigonometric evidence becomes complicated. After conducting interviews with these students, which made him difficult in the translation of trigonometric forms, he was unable to describe the relationship of trigonometric comparisons to achieve proof. Other students, many are wrong in applying general trigonometric formulas and wrong in doing algebraic calculations / computations.

Usman & Hussaini (2017) say the most frequent mistakes made by students in solving problems in trigonometry are mistakes of understanding, transformation errors, and process skill errors. Most misconceptions occur when students do not understand how to approach a given trigonometric problem from the concept. Students often misunderstand requests for questions. This may be due to the lack of emphasis by the teacher in teaching the simplification of concepts that arise, perhaps also because students only memorize the trigonometry formula. In accordance with the results of the Chigonga (2016) study, one of the causes of students having difficulty in solving trigonometry is because the knowledge they have is only procedural knowledge, they do not master conceptual knowledge. Therefore, we need to review how trigonometric learning is done in the classroom, and look for possible errors or misunderstandings of students before teaching them, so that students' difficulties in solving trigonometry problems can be overcome.

#### 4. CONCLUSION

Based on the results and discussion, the identification of students' difficulties in solving the equation and trigonometric identity is: (a) the difficulties of students in solving trigonometric equation problems, namely the difficulty of students in describing the form of the problem, difficulty in factoring the form of the quadratic equation of trigonometry, and the difficulty of using the basic trigonometric equation solving, (b) students' difficulties in solving trigonometric identity problems, namely the difficulty of students applying general trigonometry formulas, difficulties in describing each of the trigonometric comparison relationships, and the difficulty of doing algebraic calculations/computation.

#### ACKNOWLEDGEMENTS

The researchers would like to thank all parties who assisted in the implementation of this research, especially Headmaster and math teacher of SMAN 18 Bandung.

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