



## Analysis of Mathematic Understanding Ability of Senior High School Students on Trigonometric Materials

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### ABSTRACT

Mathematics has an important role in other branches of science such as physics, chemistry, economics, and others. Through mathematics, students are trained to have a mathematical understanding which will be the basis for creating problem-solving abilities. Although online learning is also balanced with many accesses to get additional deepening of material through internet media, in reality, students cannot digest all the knowledge provided through the internet media. From the difficulty of understanding this learning, the impact is that students have difficulty developing mathematical understanding abilities, which affects student learning outcomes. There is a need to increase the ability of mathematical understanding. The purpose of this study is to describe the students' mathematical understanding ability on Trigonometry material with indicators that will be described are indicators of instrumental understanding and relational indicators. Furthermore, it will be seen which indicators the most problems experienced by students. The method used is descriptive qualitative. The data was obtained from the test answers of class XI students in description questions. From the results of data analysis, it was concluded that students had low abilities in relational understanding indicators.

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## INTRODUCTION

Mathematics is one of the main sciences in the education zone because all activities carried out always use mathematical calculations according to [1]. Mathematics has an important role in other branches of science such as physics, chemistry, economics, religion, and others. Through mathematics, students are trained to have a mathematical understanding which will be the basis for creating problem-solving abilities. Calculating understanding what is being done is not limited to digesting information. Still, students can describe and transform related things in their minds to make them more meaningful, thereby helping students for solving more difficult mathematical problems [2].

At the beginning of 2020, the world of education experienced a change in learning patterns due to the coronavirus disease outbreak, which made learning done online. Changes to the education system that occur so quickly require educators to be able to carry out the online learning process. Learning that was originally done face-to-face in class must be immediately transferred to using various internet media. The implementation of online learning is certainly very influential for students. In addition to educators who must be able to master the meeting system through internet media, students are also required to be able to follow these developments. In the process of implementing online learning, students experience various obstacles. Students have difficulty understanding mathematics learning with the implementation of this online system [3]. Although online learning is

also balanced with many accesses to get additional deepening of material through internet media, in reality, students cannot digest all the knowledge provided through the internet media. Students are required to be more active in finding and digging for information about the material they are studying. It is not enough to rely on electronic media for mathematics lessons because students still have difficulty understanding mathematics. From the difficulty of understanding this learning, the impact is that students have difficulty developing mathematical understanding abilities, which affects student learning outcomes. This mathematical understanding ability is the basis for students' problem-solving abilities. Students will have difficulty solving a mathematical problem if they do not understand what is contained in the problem [4].

One of the most important things in mathematics learning activities is understanding Mathematics. Through delivery to students is instilled if the materials taught are memorized and more than understand the concept of the material being studied [5]. This is in line with the opinion of Afgani in [6]; he stated in his book that through understanding, students would better understand the concept of subject matter. Therefore mathematical understanding ability is important in learning because it provides an understanding of the material. What is taught to students is not only rote. Suppose students no longer rely on rote memorization but can develop their thinking skills through learning. In that case, they will no longer forget the materials being taught because the knowledge gained through understanding lasts longer in students' heads compared to knowledge obtained only from rote memorization.

Mathematical understanding can also be interpreted as the ability to interpret a concept. Students are considered to understand if they can use their sentences or words to explain something, unlike in the book [7]. Therefore, in ([8]), this is to obtain a mathematical understanding, the learning material must be in accordance with the level of student ability. The mathematical abilities obtained from understanding while learning mathematics include *interpreting* (interpreting), *exemplifying* (giving examples), *classifying* (classifying), *summarizing* (summarizing), *inferring* (estimating), *comparing* (comparing), and *explaining* (explaining).

In the teaching process, the most important thing is the achievement of learning objectives, where students can understand something based on what is experienced or based on experience. The level of ability that is expected for students to understand the meaning of concepts, situations, and facts that they know is called understanding [9]. Realizing a meaningful understanding, according to NCTM, the direction of mathematics learning should refer to the development of the ability to connect mathematics by sharing ideas and understanding what it looks like. Mathematical ideas are interconnected with each other to form a thorough understanding and use of mathematics outside the mathematical environment. Through understanding, students will be helped to develop the ability to think and make decisions. By having a good understanding of developing students' abilities, students will be more experienced in dealing with problems with a high level of difficulty. Students often have difficulty making decisions for the final results of discussing the problems they face because they cannot develop their thinking skills. Students tend only to want to understand the extent of the knowledge conveyed by the teacher in class without the desire to develop the knowledge to a better level of understanding. Therefore, if students develop their thinking skills, they will not experience difficulties making decisions.

Students must have the mathematical understanding ability (KPM) because the mathematical understanding ability is a requirement for someone to have problem-solving abilities (KPMM). When students have learning objectives to understand concepts, that's when the students start build mathematical thinking skills, including mathematical problem-solving abilities. In line with research

conducted by [10] to explore the achievement of students' mathematical understanding abilities by comparing contextual approach learning and ordinary learning. In contextual learning, students are more directed to understand the problems related to the material they get. So from contextual learning, students can develop their mathematical thinking skills better because they have been faced with problems in everyday life. Through this contextual learning, it is hoped that students will no longer have difficulty understanding problems related to mathematical material.

According to Rosyidah and Shohlihah in their research, understanding mathematics is a very important ability for students. Understanding mathematics can help students think systematically and help students solve difficult math problems. Understanding skills are not only for understanding information but also for making information more meaningful [4].

For learning mathematics, having the ability to understand mathematics is very important. In a copy of the decree of the head of the research and development agency and books number 028/H/KU/2021 regarding learning outcomes, it is stated that mathematical understanding is closely related to the formation of a flow of understanding of mathematics learning materials in the form of facts, concepts, principles, operations, and formal relationships. Universal, by remembering, explaining, and applying them routinely in simple cases. Where in the mathematics curriculum is so that students easily understand mathematical knowledge. If there is no ability of students to understand mathematical concepts, then the ability of knowledge and other skills is very limited [11]. The ability to understand mathematics also includes remembering concepts, using appropriate concepts, proving concepts that apply to all cases, and believing in the truth of the concept [12]. Thus understanding will help students develop how to think and make decisions [10].

The low ability of students' mathematical understanding can be seen in research [13] and [3]. In contrast to research [6], students' mathematical understanding abilities are considered moderate. Research by [14] showed that the presentation of lecture material during the Covid-19 pandemic has not been able to attract student interest and provide understanding to students of lecture material. The description above shows a need to increase the ability of mathematical understanding. Various ways can be done by teachers to improve students' understanding abilities, including: (1) students are allowed to express their ideas and ideas; (2) training students to understand mathematical problems, the teacher designs mathematics learning through related problems.

This research uses the type of mathematical understanding according to Skemp [2]. There are two types of understanding: instrumental mathematical understanding and relational mathematical understanding. First, students can use formulas in simple calculations, measured in indicators of instrumental understanding. Meanwhile, the extent to which students can relate a concept to another concept will be measured by relational indicators.

According to [15], trigonometry is a part of mathematics that deals with triangle angles and trigonometric functions. Trigonometry can also be interpreted as the science of measuring the angles and boundaries of triangles. Trigonometry is a branch of mathematics commonly used to measure lengths or angles accurately. Trigonometry plays an important role in architecture, navigation, engineering, and some branches of physics.

Trigonometry is a subject that has been studied since the elementary school level. Many problem-solving opportunities in trigonometry involve reasoning and proofing skills. It combines algebra and geometry, which includes visual representations. According to research [2], students find it very difficult to solve problems in trigonometry problems, especially problem-solving problems, because most of them are caused by a lack of mathematical understanding. In line with research [16] in [2], which in his research stated that the low ability of mathematical understanding makes it difficult

for students to work on or solve math problems, it can be seen from the indicators linking concepts that students who have high, moderate, and low abilities are still not able to relate it.

From some of the opinions above and the results of previous research related to students' mathematical understanding, here will be studied in terms of indicators of instrumental understanding and relational understanding. From the results of the study, it will be obtained on indicators of understanding where students experience more obstacles. This study aims to analyze students' mathematical understanding abilities in class XI SMA in solving trigonometry problems. The ability that is expected to be mastered by students is the ability to understand mathematics which will support the ability to develop problem-solving so that it is easier for students to find solutions to mathematical problems in accordance with indicators of mathematical understanding.

## METHODS

This type of research is qualitative descriptive research. The research was carried out at SMA Negeri 1 Gunung Toar Kab. Kuantan Singingi in the odd semester of the 2021/2022 academic year. The subject of this research is participant twenty-five participants in class XI MIPA 2 students consisting of 8 male students and 17 female students. In this study, the mathematical understanding ability test was followed by students of class XI MIPA 2 who had previously studied trigonometry. The problems in this study are problems related to the topic of Trigonometry. This research instrument uses sheet trigonometry test questions. At the same time, the written test is a data collection technique used in this study. The written test is a data collection material used in this study with a test of mathematical understanding ability in the form of a description question consisting of 5 questions of trigonometry material.

The data processing technique used is to find out how far the level of mastery of participants' mathematical understanding abilities and their interpretations is adapted from the Ministry of National Education according to the following formula and Table 1.

$$TP = \frac{Mt}{SMI}$$

Description :

TP : Class Mastery Level

Mt : Average Total Score of Students ' Answers

SMI : Ideal maximum score

The interpretation is as follows:

Table 1. Interpretation Mathematical Understanding Ability

TP Interpretation	Category
$0,80 \leq TP \leq 1$	Very high
$0,65 \leq TP \leq 0,80$	High
$0,50 \leq TP \leq 0,65$	Moderate
$0,30 \leq TP \leq 0,50$	Low
$0 \leq TP \leq 0,30$	Very low

Collection technique The data in this study used a test in the form of an essay question. In this study, the students' mathematical understanding abilities will be analyzed from the results of the answers to the essay test questions. The analysis of understanding used is based on understanding according to Skemp: (1) Instrumental understanding is memorizing something separately or can apply something to routine/simple calculations, doing things algorithmically only. (2) Relational understanding is being able to relate one thing to another correctly and be aware of the processes of problem-solving that are being carried out. In other words, every process carried out in solving

problems is interrelated and related appropriately so that it does not run away from the correct solution flow.

## RESULTS AND DISCUSSION

In this study, there were 5 questions presented to students in which each question measured both indicators of conceptual understanding. Problem no. 1 determines the value of the sum of some special angles. Problem no 2 looks for the solution set of trigonometric equations. Problem no 3 determines the cosine of the angle with the given value of tan. Problem no 4 looks for the results of trigonometric arithmetic operations. Problem no 5 looks for the set of trigonometric solutions at a certain interval. The percentage of the results of the discussion of students can be seen in Table 1 below:

Table 2. Percentage of Student Discussion Results Based on Academic Ability

No	Indicator	Percentage of Students' Ability to Answer		
		T	S	R
1	Instrumental	24% (6 students)	52% (13 students)	28% (7 students)
	Understanding			
2	Relational understanding	28% (7 students)	32% (8 students)	40% (10 students)

Based on table 1 above, it can be seen that the level of mathematical ability of students is classified as moderate in terms of indicators of instrumental understanding because of the 25 students, 13 people have moderate abilities when viewed from indicators of instrumental understanding. However, if viewed from the indicators of relational understanding, many students have low abilities. There are 10 students who cannot make answers by linking the questions with the concepts of the material that has been studied. In this case, this is in line with research [8] which concludes that the low ability of students to understand concepts is because the test results are mostly low.

### Analysis of Question Number 1

In question no 1, which determines the value of the results of the discussion of students, there are 3 abilities: low, moderate, and high. The following is one of the results of students' answers with low ability to question number 1.

$$\begin{aligned} & \sin 30^\circ + \cos 60^\circ + \cos 45^\circ \\ &= \frac{1}{2} + \frac{1}{2} + \frac{1}{2} \sqrt{3} \\ &= \frac{1}{4} + \frac{1}{2} \sqrt{3} \end{aligned}$$

Figure 1. Students' Answer Number 1 - 1

In answer to question number 1 above, students incorrectly made a question that should be a product of two angles into the addition of two angles. So that in the second step, students add values from two angles, whereas in the third step, students can't seem to add two fractions. The student also adds up the denominator, which should only be done for the numerator part of fractions if the denominators are the same. The students' mathematical understanding ability is low when viewed from the indicators of instrumental understanding because they cannot perform simple arithmetic operations. In this question, all required is the calculation of ordinary fractions, but the students do not master simple number operations as discussed above. This simple algebraic calculation has been taught since the elementary school level, so students should understand this

simple algebraic calculation. This is also related to conceptual errors made by students, in line with the opinion of [17], which states that students tend to fail to understand the formula so that they are wrong in answering questions that result in not as expected. One of the answers of moderately capable students on question number 1 is as follows.

$$\begin{aligned}
 1. \sin 30^\circ \cdot \cos 60^\circ + \cos 45^\circ &= \frac{1}{2} \cdot \frac{1}{2} + \frac{1}{2} \sqrt{2} \\
 &= \frac{1}{4} + \frac{1}{2} \sqrt{2} \\
 &= \frac{1}{2} (1 + \sqrt{2})
 \end{aligned}$$

Figure 2. Students' Answer Number 1 - 2

As seen in Figure 2, a simple problem is given, namely, only basic arithmetic operations on trigonometry problems. However, in the discussion results, students who were originally correct in doing the questions made mistakes at the end. Students want to change the answer form into another form, but if they are wrong, the student's answer should be  $\frac{1}{2} \left( \frac{1}{2} + \sqrt{2} \right)$ . From this, it can be seen that the instrumental understanding of students who cannot use ordinary calculations is seen. Students cannot perform operations on the root number because it is wrong to manipulate the final result of the answer. The following is one of the answers of students with high ability on question number 1.

$$\begin{aligned}
 \text{Nilai dari } \sin 30^\circ \cos 60^\circ + \cos 45^\circ \text{ adalah} \\
 \sin 30^\circ \cos 60^\circ + \cos 45^\circ \\
 = \frac{1}{2} \cdot \frac{1}{2} + \frac{1}{2} \sqrt{2} \\
 = \frac{1}{4} + \frac{1}{2} \sqrt{2} \\
 = \frac{1}{2} \left( \frac{1}{2} + \sqrt{2} \right)
 \end{aligned}$$

Figure 3. Students' Answer Number 1 - 3

From Figure 3, it can be seen that the answers of students who have high abilities can solve problems with the correct working steps and do algebraic manipulation for the final answer. In the results of this answer, it can be seen that students have good algebraic operation skills and can relate them to the concept of the previous material. With a good level of basic mastery like this, students will have more opportunities to develop their mathematical thinking skills, which will support problem-solving skills to solve further problems.

### Analysis of Question Number 2

In question no 2, which determines the set of solutions to the equation  $0 \leq x \leq 360$ , from the results of students' answers, there are 3 abilities: low, moderate, and high. The following are the results of students' answers with low abilities contained in question number 2.

2  $2 \sin x = -1$   
 $\sin y = -1/2$   
 $y = 20^\circ, 330^\circ$   
 $\sin = 3$   
 $x = 0$   
 $HP = (210^\circ, 330^\circ)$

Figure 4. Students' Answer Number 2-1

In the answers in Figure 4, it is very clear that students do not have a mathematical understanding, where the answers are made without going through the process of linking them with the required concepts. Answers are made haphazardly and immediately produce results without any explanation or steps to solve them. In the first step, it immediately starts with a value of  $2 \sin x = -1$  even though the problem is not given. Then in the second step, the value of  $\sin y = -1/2$  without any previous settlement procedures. For the next step, there is no relation to the previous settlement steps. This is in line with research [18], where students cannot find the relationship between this question and the previous related material. The following is the ability of students who have the moderate ability in question number 2.

2  $2 \sin x - 5 \sin x + 3 = 0$   
 $2 \sin^2 x - 6 \sin x + 5 \sin x - 3 = 0$   
 $2 \sin^2 x + (\sin x - 3) + 1 (\sin x - 3) = 0$   
 $(2 \sin x + 1) (\sin x + 1) (\sin x - 3) = 0$

Figure 5. Students' Answer Number 2 - 2

From Figure 5 above, it can be seen that students do not have a mathematical understanding of relational indicators. Students cannot relate questions to other things correctly because the questions should be separated first to make it easier to find solutions. In this student's answer, it can be seen that there is an error in algebraic operations. The answers made by students are messy and seem to be associated with superficiality. In its implementation, students are not aware of the process that must be done, so it is wrong, and they cannot complete it until the final answer. This is due to these students' arithmetical operations errors and algebraic manipulations. Students do not understand mathematical problem-solving, so the problem-solving process cannot be solved properly. The following is the ability of high-skilled students in question number 2.

Himpunan penyelesaian persamaan  $2 \sin^2 x - 5 \sin x - 3 = 0$   
 $0 \leq x \leq 360$  adalah...  
 $2 \sin^2 x - 5 \sin x - 3 = 0$   
 misal  $\sin x = a$  maka  
 $2a^2 - 5a - 3 = 0$   $x = 210, 330$   
 $(2a+1)(a-3) = 0$   $a-3 = 0$   
 $2a+1 = 0$   $a = 3$   
 $2a = -1$   $\sin x = 3$  (tidak memenuhi)  
 $a = -1/2$  jadi HP =  $\{210, 330\}$   
 $\sin x = -1/2$

Figure 6. Students' Answer Number 2 - 3

From the answers in Figure 6, it can be seen that students have good understanding abilities, namely in performing algebraic operations, and can take steps to solve problems by connecting them with concepts that have been taught. The problem-solving procedure is correct. Students have a mathematical understanding so that they can solve problems correctly.

### Analysis of Question Number 3

Question no. 3 is known as the Right triangle ABC in B and  $\tan A = \frac{2}{5}\sqrt{5}$  determines the value of  $\cos A$ . The students' answers have three abilities: low, moderate, and high. The following are the answers of low-ability students for question no. 3

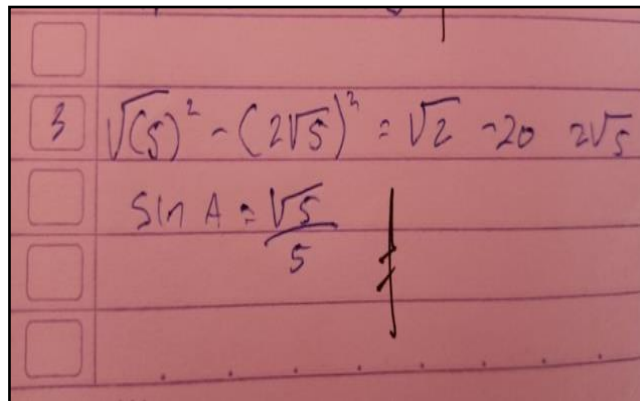


Figure 7. Students' Answer Number 3 - 1

From Figure 7, it can be seen that students cannot complete the answer to the problem because they cannot perform algebraic operations and cannot find other concepts that will be used to solve this problem. This means that these students have low abilities when viewed from instrumental understanding indicators and relational understanding indicators. Students do not seem to have the ability to solve these problems. The answers made by students are not related to the questions. Here is one of the students' answers who have the moderate ability for Question number 3.

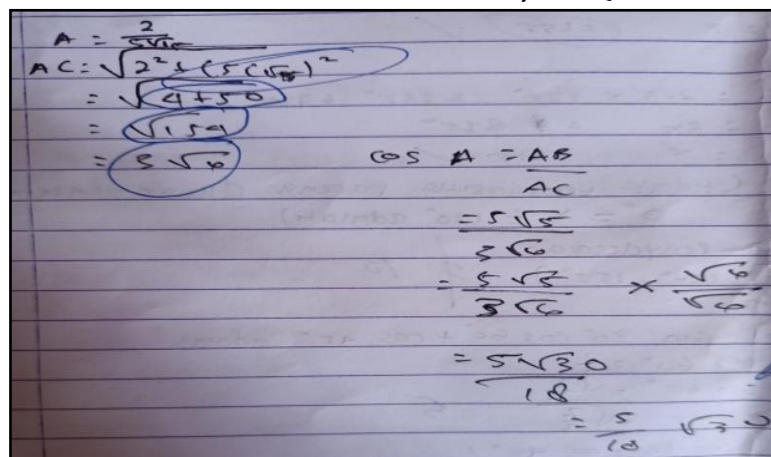


Figure 8. Students' Answer Number 3 - 2

From the answers in Figure 8, it can be seen that students complete algebraic operations by connecting questions to related concepts. Still, these students are wrong in determining the addition operation results and finding the root value. In addition, students are also wrong in understanding



what is known about the problem. From the problem, it is known  $\tan A = \frac{2}{5}\sqrt{5}$  that the mean value is equal to the value of  $\tan A = \frac{2\sqrt{5}}{5}$ . However, here students enter wrongly what is known. Students write  $5\sqrt{5}$  so that it causes errors until the final process. Here are the answers to high-ability students for Question number 3.

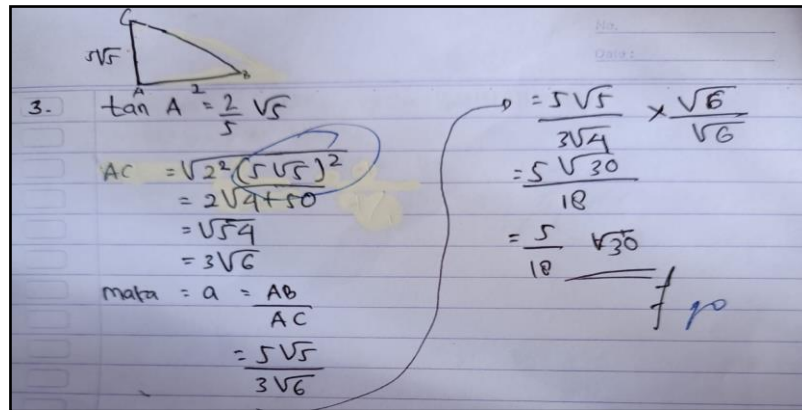


Figure 9. Students' Answer Number 3 - 3

Based on Figure 9 above, it can be seen that students already understand the algebraic operations that will be carried out and can relate the question to the previous concept. Still, it is the same with student answers-2 in Figure 8. Students misunderstand the question. From the question, it is known that the value  $\tan A = \frac{2}{5}\sqrt{5}$  is the same as the value  $\tan A = \frac{2\sqrt{5}}{5}$ . However, here students enter wrongly what is known. Students write  $5\sqrt{5}$  so that it causes errors until the final process. The answers obtained by students do not match the answer keys to the questions.

#### Analysis of Question Number 4

In question no 4, namely determining the value of  $\frac{\sin 280^\circ - \sin 20^\circ}{\cos 340^\circ - \cos 80^\circ}$ , from the results of students' answers, there are 3 abilities: low, moderate, and high. As shown in the picture below, one of the discussion results was low-ability students on the 4th question.

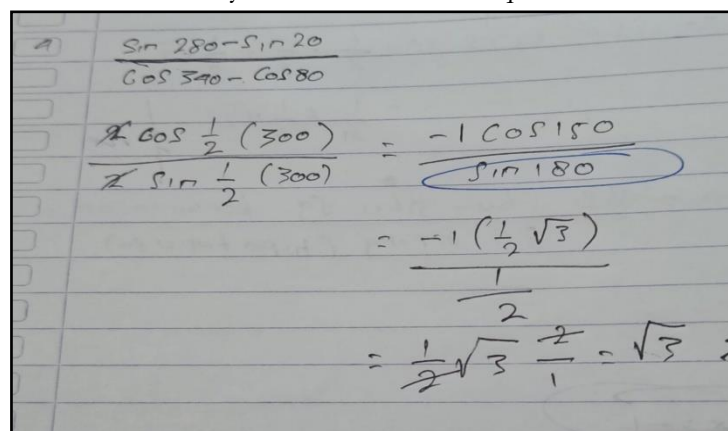


Figure 10. Students' Answers Number 4 - 1

Students did it without doing the correct procedure based on question number 4, which was

asked to complete arithmetic operations for angles that are not special. They did not relate to the properties of addition and subtraction trigonometry. Here, it can be seen that the student's mathematical understanding skills are low on relational indicators because they do not solve problems using linkages with other concepts, in line with research conducted by [2], where students make problem-solving without using trigonometric formulas for the sum and difference of two angles. The following are the answers of moderately capable students for question number 4

Jawaban:

$$\frac{2 \cos \frac{1}{2} (360) \cdot \sin \frac{1}{2} (200) - 20}{-2 \sin \frac{1}{2} (300) \cdot \sin \frac{1}{2} (340) - 00}$$

$$= \frac{-\frac{1}{2} \cos \frac{1}{2} (300) \cdot \sin \frac{1}{2} (260)}{-2 \sin \frac{1}{2} (300) \cdot \sin \frac{1}{2} (260)}$$

$$= \frac{-1 \cos 150}{\sin 150}$$

$$= -1 \left( -\frac{1}{2} \sqrt{3} \right) \Rightarrow \frac{\frac{1}{2} \sqrt{3}}{1} = \frac{\sqrt{3}}{2}$$

Figure 11. Students' Answers Number 4 - 2

From the students' answers in Figure 11, it can be seen that students can relate to the previous concepts, namely by using trigonometric rule formulas. For the problem, but in carrying out the steps for solving it, the students did not make a good solution wherein the student's answer the sign for the problem was not made from the initial step. In the next step, the quotient is also not good because it does not cover all questions. This is in line with research conducted by [19]. It can be seen that students cannot solve the problems given correctly where there are answers correctly but incomplete in the process. The students' mathematical understanding ability in answering this question is not good, so they are wrong in the steps for solving the problem. The following are the answers of high-ability students for Question number 4.

$$1. \frac{\sin 280 - \sin 20}{\cos 340 - \cos 80} = \frac{2 \cos \frac{1}{2} (280 + 20) \cdot \sin \frac{1}{2} (280 - 20)}{-2 \cdot \sin \frac{1}{2} (340 + 80) \cdot \sin \frac{1}{2} (340 - 80)}$$

$$= \frac{-2 \cos \frac{1}{2} (300) \cdot \sin \frac{1}{2} (260)}{-2 \sin \frac{1}{2} (300) \cdot \sin \frac{1}{2} (260)}$$

$$= \frac{-1 \cos 150}{\sin 150}$$

$$= \frac{-1 \left( -\frac{1}{2} \sqrt{3} \right)}{\frac{1}{2}} \Rightarrow \frac{\frac{1}{2} \sqrt{3}}{\frac{1}{2}} = \sqrt{3}$$

Figure 12. Students' Answers Number 4 - 3

Based on the students' answers from Figure 12 above, it can be seen that students understand concepts and can do calculations algorithmically. These students are classified as students with high understanding abilities. Learners have problem-solving abilities that are supported by their mathematical understanding abilities. By understanding the indicators of understanding the concept, students perform arithmetic operations correctly and understand each step of the problem-solving.

If viewed from a relational understanding, students can relate the problem to the material given, namely the trigonometric formula for the number and difference of angles.

### Analysis of Question Number 5

In question no 5, which is to determine the set of solutions  $\sin(3x + 30^\circ) = \frac{1}{2}\sqrt{2}$  at intervals  $0^\circ \leq x \leq 180^\circ$ , from the results of students' answers, there are 3 abilities: low, moderate, and high. The following are the results of the discussion of low-ability students in question number 5.

5  $\sin(3x + 30^\circ) = \frac{1}{2}\sqrt{2}$   
 $\sin(3x + 30^\circ) = \sin 45^\circ$   
 $3x + 30^\circ = 45^\circ + k \cdot 360^\circ$   
 untuk  $k = 0$ ,  $3x + 30^\circ = 45^\circ$   
 $3x = 15^\circ$   
 $x = 5^\circ$   
 untuk  $k = 1$ ,  $3x + 30^\circ = 45^\circ + 360^\circ$   
 $3x = 375^\circ$   
 $x = 125^\circ$

Figure 13. Students' Answers Number 5 – 1

From the students' answers in Figure 13, it can be seen that the students did not understand the questions, so they could not find the concepts related to the questions. Students cannot write well what is known from the problem and do not understand the solution to the problem, so they are unable to arrive at the final answer for solving the problem. From the students' answers, there is no clear information regarding the discussion of the questions made. Students' mathematical understanding is low, so it is difficult to solve problems. The following results from the discussion of moderately capable students in question no 5.

$x = a + k \cdot 360^\circ$  dan  $x = (180^\circ - a) + k \cdot 360^\circ$   
 $\sin(3x + 30^\circ) = \frac{1}{2}\sqrt{2}$   
 $\sin(3x + 30^\circ) = \sin 45^\circ$   
 maka  
 $3x + 30^\circ = 45^\circ + k \cdot 360^\circ$   
 $k = 0$ ,  $3x + 30^\circ = 45^\circ$   
 $3x = 15^\circ$   
 $x = 5^\circ$   
 $k = 1$ ,  $3x + 30^\circ = 45^\circ + 360^\circ$   
 $3x = 375^\circ$   
 $x = 125^\circ$   
 $k = 2$ ,  $3x + 30^\circ = 45^\circ + 720^\circ$   
 $3x = 735^\circ$   
 $x = 245^\circ$   
 $k = 0$ ,  $3x + 30^\circ = 135^\circ$   
 $3x = 105^\circ$   $x = ?$   
 $k = 1$ ,  $3x + 30^\circ = 135^\circ + 360^\circ$   
 $3x = 465^\circ$   
 $x = 155^\circ$   
 $k = 2$ ,  $3x + 30^\circ = 135^\circ + 720^\circ$   
 $3x = 825^\circ$   
 $x = 275^\circ$   
 Jadi himpunan penyelesaiannya  $\{5^\circ, 125^\circ, 155^\circ, 275^\circ\}$

Figure 14. Students' Answers Number 5 - 2

From Figure 14, it can be seen that the student's answers were almost correct, but the students made some mistakes in doing the arithmetic operations. In the settlement set section, it can also be seen that there are answers that have no completion steps at the top of the student's review. These students are included in moderate ability students because they can apply existing concepts related to questions but are still wrong in implementing the steps for solving problems. The following is a discussion of high-ability students for question number 5.

$\text{Diketahui: } \sin(3x+30^\circ) = \frac{1}{2}\sqrt{3}$   
 $\sin(3x+30^\circ) = \sin 45^\circ$   
 $3x+30^\circ = 45^\circ + k \cdot 360^\circ$   
 $3x+30^\circ = 135^\circ + k \cdot 360^\circ$   
 $3x+30^\circ = 45^\circ + k \cdot 360^\circ$   
 $3x = 15^\circ + k \cdot 360^\circ$   
 $x = 5^\circ + k \cdot 120^\circ$   
 $k=0 \rightarrow x = 5^\circ + 0 \cdot 120^\circ = 5^\circ$   
 $k=1 \rightarrow x = 5^\circ + 1 \cdot 120^\circ = 125^\circ$   
 $k=2 \rightarrow x = 5^\circ + 2 \cdot 120^\circ = 245^\circ$   
 $3x+30^\circ = 135^\circ + k \cdot 360^\circ$   
 $3x = 105^\circ + k \cdot 360^\circ$   
 $x = 35^\circ + k \cdot 120^\circ$   
 $k=0 \rightarrow x = 35^\circ + 0 \cdot 120^\circ = 35^\circ$   
 $k=1 \rightarrow x = 35^\circ + 1 \cdot 120^\circ = 155^\circ$   
 $k=2 \rightarrow x = 35^\circ + 2 \cdot 120^\circ = 275^\circ$   
 Jadi  $= 5^\circ, 35^\circ, 125^\circ, 155^\circ$

Figure 15. Students' Answers Number 5 – 3

Students with a high understanding can carry out the steps of working on algebraic operations appropriately and can relate questions to related concepts well or restate concepts. In line with the results of the discussion of research conducted by [20], understanding the concept of restating needs to be owned by students. In their research, the understanding of concepts on the repeat indicator shows a percentage of 73.40%, where this percentage is included in the high or good category.

Based on the results of the data obtained, it can be concluded that the students' mathematical understanding ability is still low than 50%. From the answers to the test questions, it can be seen that students do not yet have good understanding abilities, or students' understanding abilities are still low on trigonometry material. This is in line with the research results conducted by [21]. In conclusion, the results of his research stated that the level of mastery of students' mathematical understanding abilities of trigonometry material showed very low results and was in line with the opinion [4] in his research. This is due to students' lack of active participation in building their concepts and only remembering a few formulas given. Students seem not to desire to have a good mathematical understanding ability. Students' activeness and strong will to increase their knowledge without depending on the answers given by friends and material obtained from the teacher is one way to improve students' mathematical understanding. This is in line with research conducted [22], where students who already understand the concept will tend to find it easier to solve mathematical problems. Therefore, mathematical understanding is needed to support students' understanding of problem-solving.

## CONCLUSIONS AND SUGGESTIONS

Based on the discussion and results in this study, it can be stated that students have a poor mathematical understanding. It can be seen from the results of the percentage of students' answers

measured through indicators of instrumental understanding and indicators of relational understanding. Students with high abilities have good mathematical understanding skills when measured from indicators of instrumental understanding and indicators of relational understanding. Because students with high abilities can perform arithmetic operations well and relationship problems to the concepts of the material studied. However, this is not the case for students with moderate and low abilities who still have poor mathematical understanding abilities. Relational understanding indicators can be seen in the low ability of students with moderate and low abilities to use formulas and perform simple calculations. Furthermore, in mathematical understanding for relational understanding indicators, students cannot solve problems using other concepts related to the problem. Students find it difficult to find concepts related to the questions given. When viewed from the results of the percentage of students' answers for instrumental and relational understanding indicators, most of the students have a low understanding of the indicators of relational understanding. Thus it can be concluded that the students' understanding ability is low on the relational understanding indicator.

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