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Accuracy of ChatGPT for Basic Values of Trigonometric Functions

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ABSTRACT : This study analyzes the accuracy of ChatGPT, an artificial intelligence model based on GPT-3.5, in determining the values of basic trigonometric functions. To this end, we examine ChatGPT's responses to sine, cosine, tangent, and cotangent values for a wide range of angles. We compare the results provided by ChatGPT with the accuracy values determined by basic trigonometry. We also explore differences in accuracy depending on changes in question complexity and given context. The results show a high level of accuracy of ChatGPT in determining the values of trigonometric functions, especially for common angles. However, it is noted that accuracy may be affected in certain cases of extreme angles or complex questions. This analysis provides an important representation of ChatGPT's capabilities in the field of mathematics, using a new method for testing the accuracy of artificial intelligence models in determining trigonometric values.

Keywords -Accuracy, AI Model, ChatGPT, Trigonometric Functions, Trigonometry

I. INTRODUCTION

In today's era of technology development, artificial intelligence (AI) has reached unpredictable levels of advancement. AI models such as ChatGPT are capable of displaying a wide variety of skills, including natural language understanding and complex problem-solving. In this context, one of the main challenges is to understand the accuracy and performance of these models for certain data, such as the values of trigonometric functions.

Our study aims to focus on the accuracy value of ChatGPT in determining the values of basic trigonometric functions such as sine, cosine, tangent, and cotangent for a wide range of angles. This research makes an important contribution to understanding the capabilities of AI models in the field of mathematics, especially in this case, in the field of trigonometry.

In the field of artificial intelligence (AI), one of the main challenges is the development of models capable of understanding and handling the given information effectively and accurately. In this context, ChatGPT is one of the latest models that has achieved success in many aspects of artificial intelligence, including natural language understanding and its answers to various questions.

In mathematics, trigonometric functions, such as sine, cosine, tangent, and cotangent, play an important role in many fields, including engineering, physics, and computer science. To use these functions in practical applications, it is important to have an efficient way to determine their values for given angles.

Our focus in this area is important to deepen our understanding of the performance and capabilities of AI models in various domains and to use this information to improve their practical applications. Furthermore, this study may contribute to future research regarding the use of AI in mathematics and other sciences.

1.1. The importance of the study

The importance of this study moves in several directions that affect different fields:

Improving artificial intelligence models: If ChatGPT or similar models can be used accurately to determine trigonometric values, this will mark a significant step forward in advancing artificial intelligence capabilities in the field of mathematics.

Applications in computer science and engineering: A high accuracy in the determination of trigonometric values can be used to develop practical applications in engineering, computer graphics, 3D modeling, and other technologies.

Facilitating natural language processing: The study could provide information about AI models' abilities to understand and handle mathematical concepts, including trigonometric functions, which are essential for developing applications that help understand natural language. This can also provide information on how humans and computers transmit and interpret information.

For these reasons, research in this area is important to understand and advance the potential of artificial intelligence in mathematics and its applications in many fields of natural sciences.

1.2. Purpose of the study

The purpose of this study is to evaluate the accuracy and performance of the ChatGPT model in determining the values of the basic trigonometric functions for a wide range of angles. In particular, we aim to understand how the model copes with the challenges of moving from general information to text in determining the numerical values of certain angles.

To this end, we examine the model's responses to a series of trigonometric questions and compare them to the accuracy values determined by basic trigonometric calculations. In addition, we aim to identify factors that may affect the accuracy of the model in determining trigonometric values, including the complexity of the questions and the given context.

This analysis provides an important contribution to our understanding of the performance of artificial intelligence models in the field of mathematics, especially their use for determining numerical values. In addition, the results of this study can serve as a basis for the improvement and development of future artificial intelligence models in this field.

1.3. Research objectives

1. To evaluate the accuracy of the ChatGPT model in determining the values of trigonometric functions for a wide range of angles.
2. Compare the accuracy of ChatGPT with the accuracy values determined by basic trigonometry to identify differences and matches.
3. To analyze the differences in accuracy depending on the complexity of the questions and the given context.
4. To identify factors that can affect the accuracy of ChatGPT in determining trigonometric values.
5. To provide a contribution to the understanding of the performance of artificial intelligence models in the field of mathematics, using a new method for testing their accuracy in determining trigonometric values.

II. LITERATURE REVIEW

Trigonometric functions also known as circular functions can be simply defined as functions of an angle of a triangle. This means that the relationship between the angles and sides of a triangle is given by these trigonometric functions. The basic trigonometric functions are sine, cosine, tangent, cotangent, secant, and cosecant. The trigonometric values of various ratios, such as sine, cosine, tangent, secant, cotangent, and cosecant, are obtained by measuring the lengths and angles of right triangles. The values of the trigonometric functions for 0°, 30°, 45°, 60°, and 90° are commonly used to solve trigonometry problems (Brown et. al., 2011).

Can ChatGPT do math? As a language model, ChatGPT is trained on a large corpus of text, allowing it to generate human-like responses to a wide range of requests. However, a question that often arises is whether ChatGPT is capable of performing mathematical calculations. The short answer is yes, ChatGPT can do the math. However, his abilities are limited when it comes to complex mathematics. ChatGPT's capabilities are even more limited when it comes to geometry and trigonometry. While it can handle basic formulas, such as the area of a triangle or the circumference of a circle, it struggles with more complex problems (Yohai, 2023). ChatGPT has the fastest-growing user base. People are trying different kinds of experiments to generate emails, poems, codes, and whatnot. There are many viral examples showing that ChatGPT fails at math. Recently on January 30, 2023, OpenAI released the latest version with the message that the tool has been updated for mathematical reasoning (Parmar, 2023). The test conducted by Shakarian showed that ChatGPT's accuracy on math problems is below 60%, which is less than the average accuracy of a high school student. In short, ChatGPT can help you write an article, but you can be fooled while doing some basic math calculations with ChatGPT (Yavuz, 2024). Findings from Orhani (2021) show that artificial intelligence can inform further investigations to support learning design and assessment in learning progression (Orhani, 2021).

ChatGPT (Chat Generative Pre-Trained Transformer) is a chatbot developed by OpenAI and launched on November 30, 2022. Based on a large language model, it enables users to refine and direct a conversation towards a length, format, style, desired level, details, and language. Consecutive requests and responses, known as rapid engineering, are considered at each conversational stage as a context (Samantha, 2022). ChatGPT is

available for use online in two versions, one built on GPT-3.5 and the other on GPT-4, both of which are members of OpenAI's proprietary series of generative pre-trained transformer (GPT) models) and is well-tuned for conversational applications that use a combination of supervised learning and reinforcement learning from human feedback (Gertner, 2023).

GPT-4 correctly identified the number 17077 as a prime number 97.6% of the time. However, just three months later, his accuracy on this task dropped to 2.4%. Meanwhile, the GPT-3.5 model showed conflicting results. GPT-3.5 could correctly identify 17077 as a prime number only 7.4% of the time. However, his accuracy on this task had increased to 86.8%. The researchers attributed this wild swing in performance to the way GPT-4 is trained. It is trained on a large dataset of text and code, including math problems. When GPT-4 is first trained, it can learn to solve mathematical problems relatively well. However, as it is exposed to more data, it also learns other things – sometimes incorrectly. Unfortunately, this exposure can lead to the tool forgetting how to solve math problems or—worse—learning to solve them incorrectly. Citing the findings of the AI math decline The researchers conclude: "Our findings show that the behavior of GPT-3.5 and GPT-4 has changed significantly over a relatively short time. In other words, GPT-4 is still not reliable for solving math problems. The researchers also mentioned that they are continuing to study this to see if the problem persists (Greenleaf, 2023).

Recent LLMs, for example, PaLM by Chowdhery et al. (2022) released in 2022, are tested only on elementary-level mathematical reasoning datasets (Chowdhery et al., 2022), such as groups of MathQA or GSM8K data (Amini et al., 2019; Cobbe et al., 2021). We suspect this is due to the lack of advanced-level natural language mathematics datasets. Moreover, the results obtained show that the models at the time had difficulties with data sets much simpler than ours. For example, the 540-billion-parameter version of PaLM correctly solves only 58% of the GSM8K dataset problems, even with chain-of-sight prompting and access to an external calculator (Chowdhery et al., 2022). This model however outperforms GPT-3 (Brown et al., 2021), which only achieves 54% in the same data set. Variations of BERT (Piekos, 2020) have been shown to solve only between 28% and 37% of problems when adjusted and tested on the Algebra Question Answering with Rationales (AQuA-RAT) dataset (Ling et al., 2017), which is the direct predecessor of MathQA. For some models, such as BLOOM (Scao et al., 2022) or the LaMDA model (Thoppilan et al., 2022), (both released in 2022), an assessment of mathematical reasoning ability is completely missing. An updated study on mathematical datasets and the performance of different LLMs can be found in (Liang, et al., 2022).

Can ChatGPT be good at math? The short answer is "Yes", it can be and will be in the future. While the basic version of ChatGPT may have limitations in handling complex mathematical problems, it is possible to adjust and customize the model to improve its mathematical capabilities (Zvornicanin & Piwowarek, 2024). Also, according to the study by Orhani, (2023), it helps students and provides them with a better learning experience (Orhani, 2023).

The field of education may undergo a revolution due to recent advances in natural language processing (NLP), which have led to the development of increasingly complex language models such as GPT-3. Due to its capacity to produce natural language answers to a variety of questions, ChatGPT, a large language model based on the GPT architecture, has attracted great interest in the educational community. In recent years, there has been an increase in interest in the use of chatbots, especially ChatGPT, in education. Some research has investigated the potential advantages, issues, and difficulties of this practice. Halaweh (2023) addressed educators' concerns about the adoption of ChatGPT in educational contexts, arguing for its inclusion and providing guidelines for safe implementation (Halvak, 2023). In research on the potential effects of ChatGPT in education, Zhai (2023) recommended changing the learning objectives to emphasize students' creativity and critical thinking (Zhai, 2023). In their discussion of the potential advantages and difficulties of using large language models in educational contexts, Kasneci et al. (2023) emphasized the demand for competencies and knowledge to understand the technology and its limitations (Kasneci et al., 2023).

The study by Cheng and Yu (2023) evaluates the performance of ChatGPT on elementary-level math problems and highlights the need for further research to develop models that can effectively reason about mathematical concepts and solve problems that require arithmetic operations. While the findings suggest that ChatGPT's arithmetic and ability to solve math word problems lags behind coherence and natural language understanding, we acknowledge that the model's performance is still better than that of previous models in this area. We also recognize the significant impact of pre-training corpus models and specific types of errors on model performance, which warrants further exploration (Cheng & Yu, 2023).

III. METHODOLOGY

3.1. Data selection

For this study, we used a carefully selected database that contained a wide range of angles specified for use in determining trigonometric values. The angles were chosen in a random and scaled manner to ensure a consistent representation of different trigonometric situations.

3.2. Implementation of the ChatGPT model

To retrieve the responses of the ChatGPT model, we used an off-the-shelf implementation of the model and an application programming interface (API) to perform queries and retrieve responses automatically. This process was conducted in a protected and monitored environment to ensure data security and accuracy.

3.3. Accuracy assessment

To evaluate the accuracy of the model, we compared the answers given by ChatGPT with the accuracy values determined by the basic trigonometry for which the angle is determined. We used a rating scale to score the differences between the answers provided by the model and the accuracy values.

3.4. Analysis of the results

The results were analyzed including assessing the accuracy of ChatGPT in determining trigonometric values depending on the angle and complexity of the questions. Also, the effects of various factors, such as changing the complexity of the questions and the context provided, were examined.

3.5. Validation and ranking of results

Results were validated using methods of descriptive statistics and analysis of variance to reveal key trends and differences. In addition, a ranking of the results was done to identify the most important matches and differences.

IV. RESULTS

4.1. Accuracy analysis of the ChatGPT model

In this chapter, we present the results of our research into the accuracy of the ChatGPT model in determining the values of trigonometric functions for a wide range of angles. For this purpose, we analyzed the responses of the model for several certain angles and compared them with the accuracy values calculated by basic trigonometry. Initially, a wide range of set angles containing fundamental angles was selected to test the accuracy of the model in different situations. Then, for each angle, the model was given a question to determine the value of the sine, cosine, tangent, and cotangent for the given angle.

Below we present the results obtained by ChatGPT for the values of the trigonometric functions:

Table 1. Results of trigonometric functions from ChatGPT

	sin	cos	tg	ctg
0°	0	1	0	$N.D.$
30°	0.5	$\frac{\sqrt{3}}{2}$	$\frac{1}{\sqrt{3}}$	$\frac{\sqrt{3}}{3}$
45°	$\frac{\sqrt{2}}{2}$	$\frac{\sqrt{2}}{2}$	1	1
60°	$\frac{\sqrt{3}}{2}$	$\frac{1}{2}$	$\sqrt{3}$	$\sqrt{3}$
90°	1	0	$N.D$	0
120°	$\frac{\sqrt{3}}{2}$	$-\frac{1}{2}$	$-\sqrt{3}$	$-\sqrt{3}$
135°	$-\frac{\sqrt{2}}{2}$	$-\frac{\sqrt{2}}{2}$	-1	-1
150°	$-\frac{1}{2}$	$\frac{\sqrt{3}}{2}$	$-\sqrt{3}$	$-\sqrt{3}$
180°	0	-1	$N.D.$	0

210°	$-\frac{1}{2}$	$-\frac{\sqrt{3}}{2}$	$-\sqrt{3}$	$-\sqrt{3}$
225°	$-\frac{\sqrt{2}}{2}$	$-\frac{\sqrt{2}}{2}$	1	1
240°	$-\frac{\sqrt{3}}{2}$	$-\frac{1}{2}$	$-\sqrt{3}$	$-\sqrt{3}$
270°	-1	0	$N.D.$	0
300°	$-\frac{1}{2}$	$\frac{\sqrt{3}}{2}$	$-\sqrt{3}$	$-\sqrt{3}$
315°	$-\frac{\sqrt{2}}{2}$	$-\frac{\sqrt{2}}{2}$	1	1
330°	$-\frac{1}{2}$	$-\frac{\sqrt{3}}{2}$	$-\sqrt{3}$	$-\sqrt{3}$
360°	0	1	$N.D.$	0

Below we present the exact values of the trigonometric functions:

Table 2. Values of trigonometric functions

	sin	cos	tg	ctg
0°	0	1	0	∞
30°	$\frac{1}{2}$	$\frac{\sqrt{3}}{2}$	$\frac{\sqrt{3}}{3}$	$\sqrt{3}$
45°	$\frac{\sqrt{2}}{2}$	$\frac{\sqrt{2}}{2}$	1	1
60°	$\frac{\sqrt{3}}{2}$	$\frac{1}{2}$	$\sqrt{3}$	$\frac{\sqrt{3}}{3}$
90°	1	0	∞	0
120°	$\frac{\sqrt{3}}{2}$	$-\frac{1}{2}$	$-\sqrt{3}$	$-\frac{\sqrt{3}}{3}$
135°	$\frac{\sqrt{2}}{2}$	$-\frac{\sqrt{2}}{2}$	-1	-1
150°	$\frac{1}{2}$	$-\frac{\sqrt{3}}{2}$	$-\frac{\sqrt{3}}{3}$	$-\sqrt{3}$
180°	0	-1	0	∞
210°	$-\frac{1}{2}$	$-\frac{\sqrt{3}}{2}$	$\frac{\sqrt{3}}{3}$	$\sqrt{3}$

225°	$-\frac{\sqrt{2}}{2}$	$-\frac{\sqrt{2}}{2}$	1	1
240°	$-\frac{\sqrt{3}}{2}$	$-\frac{1}{2}$	$\sqrt{3}$	$\frac{\sqrt{3}}{3}$
270°	-1	0	∞	0
300°	$-\frac{\sqrt{3}}{2}$	$\frac{1}{2}$	$-\sqrt{3}$	$-\frac{\sqrt{3}}{3}$
315°	$-\frac{\sqrt{2}}{2}$	$\frac{\sqrt{2}}{2}$	-1	-1
330°	$-\frac{1}{2}$	$\frac{\sqrt{3}}{2}$	$-\frac{\sqrt{3}}{3}$	$-\sqrt{3}$
360°	0	1	0	∞

After receiving the responses from the model, the given values were compared with the accuracy values determined by basic trigonometry. We used a rating scale to score the differences between the answers given by the model and the accuracy values. This allowed us to evaluate the accuracy of the model for any given angle and trigonometric function.

The results of this analysis will include evaluating the accuracy of the model according to the given angles, as well as identifying any significant differences between the model responses and the accuracy values. This analysis provides us with an in-depth understanding of the model's capabilities in determining trigonometric values and can be used to identify areas for improving the model's performance in the future.

In both tables, the values of trigonometric functions for certain angles from 0° to 360° are presented. Table 1 presents the results of the trigonometric functions from ChatGPT, while Table 2 presents the values of the trigonometric functions defined in mathematics.

In a comparison of the two tables, it is observed that some values of the trigonometric functions match between the two tables, such as for the angles 0°, 30°, 45°, 60°, 90°, 120°, 135°, 150°, 180°, 210°, 225°, 240°, 270°, 300°, 315°, 330° and 360°. This shows that the ChatGPT model has managed to determine some correct values of the trigonometric functions.

However, there are some differences between the two tables. In some cases, the values determined by ChatGPT do not match the values determined in Math. These differences may be the result of perhaps not having enough information about the model to understand the context of the query, or they may be a consequence of the complexity of the queries.

The results of Tables 1 and 2 show that the ChatGPT model has 23 wrong answers out of a total of 68 requests for the values of trigonometric functions. The results of Tables 1 and 2 show that the ChatGPT model has an accuracy of 66.18% in determining the values of the trigonometric functions in this study. In all 68 submitted requests, 45 of them turned out to be correct, while 23 of them turned out to be wrong. This indicates that the model has a mixed level of accuracy and error in its responses to the values of the trigonometric functions.

The interpretation of this result for this study is important to understand the performance and capabilities of the ChatGPT model in this specific task. An accuracy of 66.18% may be acceptable for some applications, but it also indicates that the model needs improvements and increases in its accuracy to be a more reliable source for determining trigonometric values.

4.2. Model performance in different situations

In our analysis, we evaluated the performance of the model in different situations, including the complexity of the questions and the given context. The analysis of the results of this study shows that the performance of the ChatGPT model in determining the values of trigonometric functions varies depending on the context and characteristics of the questions. By evaluating the accuracy of the model on a series of different questions, the differences in its performance are observed from the following perspectives:

The model shows a different accuracy for the values of the trigonometric functions based on the given angle. At some common angles such as 0°, 30°, 45°, 60°, 90°, 180°, 270°, and 360°, the model shows a higher accuracy, providing accurate answers to trigonometric functions. However, for rarer angles such as 135°, 225°, and 315°, the performance of the model may be more limited, causing indeterminate or erroneous answers.

Questions that require in-depth knowledge of trigonometry or the use of trigonometric functions in more complex contexts may yield poorer results from the model. In such situations, the model may be less able to understand and respond accurately, causing large errors or indeterminate responses.

Variations in the way questions are worded or presented can affect the model's ability to understand and respond accurately. Clear and understandable questions help model performance, while intractable or incorrect formatting can cause confusion and poor results.

It is worth noting that the ChatGPT model in the first cases for tangent and cotangent gave correct answers, but after rationalizing the expression it came to an error. As an example, we can give $ctg60° = \frac{1}{\sqrt{3}}$, while the ChatGPT model after rationalization gives the wrong answer as $\sqrt{3}$. The solution would be like this: $\frac{1}{\sqrt{3}} = \frac{1}{\sqrt{3}} \cdot \frac{\sqrt{3}}{\sqrt{3}} = \frac{\sqrt{3}}{3}$. It is worth noting that the ChatGPT model also guessed some wrong solutions in the signs of the values of the trigonometric functions.

In general, the performance of the ChatGPT model in determining the values of trigonometric functions varies depending on many different factors, including the context of the questions, their complexity, and their formatting. Identifying these factors is critical to understand the model's capabilities and limitations in this task and to develop strategies for improving its accuracy in the future.

4.3 Identification of factors affecting accuracy

During our analysis, we identified several factors that can affect the accuracy of the model. These factors include the level of complexity of the questions, the initial accuracy of the model on similar answers, and the influence of the given context.

In the analysis of this result, it is important to identify the factors that may have influenced the model errors. These factors may include the lack of sufficient information to understand the context of the question, the complexity of the questions, as well as the limitations of the model in determining the numerical values of the trigonometric functions.

Therefore, the Model may have encountered questions with insufficient information to fully understand the context of the question and provide an accurate answer. Trigonometric functions are complicated, and their answers vary depending on the value of the angle and its quadrant. The lack of sufficient information to interpret these changes may have led to errors in model responses. Some questions dealing with trigonometric functions can be complex, requiring in-depth knowledge of trigonometry to give a correct answer. The ChatGPT model may have encountered these questions which are outside of its level of trigonometry knowledge, leading to incorrect answers. Although the ChatGPT model is advanced and advanced, it still has its limitations. The model is trained with a certain amount of data and cannot understand context in the same way as humans. However, the limitations of the model may have affected its ability to provide accurate answers to certain questions. Another factor that may have affected the performance of the model is variation in the way the questions were worded or formatted. If the formatting of the questions is not clear or consistent, the model may have difficulty understanding and answering them accurately.

These factors may be responsible for differences in model accuracy in trigonometric function responses, and their identification may help improve model performance in the future. So, to improve the performance of the model in this task, further research can be considered to expand the model database, improve the machine learning algorithms, as well as increase the quantity and quality of information provided to the model to allow an understanding deeper and more accurate of such trigonometric questions.

4.5. Discussion of results and their interpretation

The results were found to serve as a basis for an in-depth discussion on the performance and capabilities of the ChatGPT model in the field of mathematics, especially about the determination of trigonometric values. In this study, the accuracy of the ChatGPT model in determining the values of trigonometric functions was explored. The search results showed a percentage accuracy of 66.18%, including 23 wrong answers out of a total of 68 requests for the values of trigonometric functions. In the results, several factors were identified that may have affected the performance of the model. The lack of sufficient information, the complexity of the questions, model limitations, and variations in formatting are some of the factors that may have affected the accuracy of the model in answering trigonometric functions. An in-depth analysis of the differences in accuracy provides a deeper understanding of the capabilities and limitations of the model in determining trigonometric values. The model has shown an acceptable level of accuracy in some common angles, while it has had less success in some rarer angles or more complex queries.

The first objective of the study was to evaluate the accuracy of the ChatGPT model in determining the values of the trigonometric functions for a wide range of angles. Through this objective, it was intended to understand the model's ability to provide accurate and reliable answers to trigonometric functions through the analysis of many angles from 0° to 360°. By evaluating the model's accuracy over a wide range of angles, areas were identified where the model performed better and where it needed improvement. This analysis of model accuracy for a wide range of trigonometric function angles provided a deep understanding of the capabilities and limitations of the ChatGPT model in this specific task.

The second objective of the study was to compare the accuracy of the ChatGPT model with accuracy values determined by basic trigonometry to identify differences and matches. This objective was intended to analyze the performance of the ChatGPT model in comparison with the accuracy values determined through basic trigonometry for the trigonometric functions. Through this objective, accuracy differences between the ChatGPT model and the accuracy values from basic trigonometry were identified to understand in which cases the model provided correct answers and in which cases it failed to match the standard accuracy values. The difference-and-match analysis showed a percentage accuracy of 66.18%, including 45 correct answers and 23 wrong answers out of a total of 68 questions submitted for the values of trigonometric functions.

The third objective of the study was to analyze differences in accuracy depending on the complexity of the questions and the given context. This analysis aimed to identify how the performance of the ChatGPT model varied depending on the level of complexity of the questions and the context in which they were presented. For this objective, different questions were considered which contained different information or required different knowledge of trigonometry. For example, some questions might be simpler and require the definition of trigonometric functions for known angles, while other questions might be more complex and require the use of trigonometric functions in more complicated contexts. Through this objective, it is understood how the performance of the model varied under these different conditions and in which situations the model provided more correct or incorrect answers. Analysis of these changes was observed in the complexity of questions such as tangent and cotangent of trigonometric functions for several angles.

The fourth objective of the study was to identify factors that may affect the accuracy of the ChatGPT model in determining trigonometric values. To achieve this objective, a detailed analysis of the model's results was performed to reveal potential factors that may have influenced its performance. Some of the factors identified that may have affected the accuracy of the model include: If the model did not have enough information to understand the context of the question or to detect changes in the trigonometric functions based on the given angle, this may have led to the answer undefined or wrong; Questions requiring in-depth knowledge of trigonometry or the use of trigonometric functions in complex contexts may have posed challenges to the model. The complexity of the questions and the lack of clarity in their interpretation may have affected the model's ability to provide accurate answers; Although the ChatGPT model is advanced, it still has its limitations. The model may have had difficulty understanding or processing certain questions, especially those requiring specialized knowledge; Intractable or incorrect question formatting may have affected the model's ability to understand and respond accurately. Worded and understandable questions enabled more accurate responses from the model.

The fifth objective of the study was to contribute to the understanding of the performance of artificial intelligence models in the field of mathematics, using a new method for testing their accuracy in determining trigonometric values. To achieve this objective, a special methodology was used to evaluate the accuracy of the ChatGPT model in handling questions related to trigonometric functions. This methodology involved examining a wide range of angles and complexities of trigonometric questions to create a complete picture of the model's performance. By focusing on model performance in certain aspects of mathematics, such as trigonometric functions, it was intended to write a new chapter in the field of artificial intelligence in mathematics, bringing a new methodology for testing artificial intelligence models in this specific domain. Through this objective, a contribution is made to the development of knowledge about the performance of artificial intelligence models in mathematics, providing a usable and efficient methodology for testing their accuracy in determining trigonometric values. This methodology can serve as a suitable model for evaluating the performance of other artificial intelligence models in similar areas of mathematics, helping to understand and fulfill their potential in handling complex mathematical tasks.

From the results found, some implications and challenges for the future emerge. To improve the performance of the model in determining trigonometric values, it is important to further develop the machine learning algorithms, expand the model database, and better understand the context of the questions to allow a more accurate answer and believable.

V. CONCLUSION

In this study, the accuracy of the ChatGPT model in determining the values of trigonometric functions was examined. The analysis of the findings provided insight into the performance of this model in dealing with the specific mathematics task. From our findings, we can say that the ChatGPT model provided an acceptable level of accuracy in determining the values of trigonometric functions. However, several wrong answers were detected from many different angles, indicating the need for possible improvements in its performance. The analysis of the results showed that the performance of the model varies depending on the given context and the complexity of the questions. Simpler questions with clear context provided better results, while more complex questions may have caused additional challenges for the model. Also, various factors that may have affected the accuracy of the model were identified, such as lack of information, the complexity of the questions, limitations of the model, and variations in the formatting of the questions, providing a clear impression of the factors that should be considered for improving its performance. From the results found, some implications and challenges for the future emerge. To improve the performance of the ChatGPT model in dealing with complex mathematical tasks, it is important to incorporate appropriate strategies to address the factors affecting its accuracy. This study provides an important contribution to the field of artificial intelligence and mathematics by examining the performance of a well-known model in handling the values of trigonometric functions. In conclusion, this study provides a detailed look at the performance of the ChatGPT model in handling trigonometric values and provides a basis for further research and improvement of artificial intelligence techniques in the field of mathematics.

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