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ANALYSIS OF ADVANCED MATHEMATICS BOOKS BASED ON PANCASILA PROFILE ON CRITICAL REASONING DIMENSIONS

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Abstract : *Pancasila students embody Indonesian students who have competence and behave according to Pancasila values. One of the elements of the Pancasila profile is critical reasoning which is contained in advanced mathematics books and will be a provision for Indonesian students, especially phase E at SMA/SMK levels in an effort to develop themselves and face challenges in the 21st century. The purpose of this research is to analyze student books in accordance with aspects of the values of the Pancasila Student Profile which focus on elements of critical reasoning and provide recommendations as material for consideration in improving student books. This type of research is qualitative with a descriptive approach. The results obtained are books that are relevant and encourage students to reason critically by presenting various problem solutions, and there is a special column entitled "Mari Berpikir Kritis" in each chapter which leads students to reason critically in understanding various advanced issues. However, this book still has drawbacks, namely the critical thinking column in each chapter has a different presentation measure. This is due to the difficulty level of each chapter presented. Totally, this book has been able to become one of the supports in forming a nation's generation that has a critical reasoning dimension on the Pancasila Profile.*

Keywords : *Student Book; Advanced Mathematics; Critical Reasoning.*

Abstrak : *Pelajar Pancasila merupakan perwujudan pelajar Indonesia yang memiliki kompetensi dan berperilaku sesuai dengan nilai-nilai Pancasila. Salah satu elemen profil pelajar Pancasila yaitu bernalar kritis termuat dalam buku Matematika tingkat lanjut yang akan menjadi bekal pelajar Indonesia khususnya fase E jenjang SMA/SMK dalam upaya mengembangkan diri dan menghadapi tantangan di abad 21. Tujuan dari penelitian ini untuk menganalisis buku siswa sesuai dengan aspek nilai-nilai Profil Pelajar Pancasila yang terfokus pada elemen bernalar kritis serta memberikan rekomendasi sebagai bahan pertimbangan dalam penyempurnaan buku siswa. Jenis penelitian ini adalah kualitatif dengan pendekatan deskriptif. Hasil yang diperolah adalah buku yang relevan dan mendorong siswa untuk bernalar kritis dengan menyajikan berbagai pemecahan masalah, serta terdapat kolom khusus berjudul "Mari Berpikir Kritis" di setiap bab yang menggiring siswa untuk bernalar kritis dalam memahami berbagai persoalan tingkat lanjut. Namun, buku ini masih memiliki kekurangan yaitu kolom berpikir kritis dalam setiap bab memiliki takaran penyajian yang berbeda. Hal ini disebabkan oleh tingkat kesulitan masing-masing bab yang dipaparkan. Selebihnya buku ini sudah mampu menjadi salah satu penunjang dalam membentuk generasi bangsa yang memiliki Profil Pelajar Pancasila.*

Kata Kunci : *Buku Siswa; Matematika Tingkat Lanjut; Nalar Kritis.*

INTRODUCTION

The national education system is set of interrelated educational components related to each other and can achieve goals National Education. The curriculum is inseparable of a set of educational components. The curriculum is regulated by the Ministry of Education and Culture of the Republic of Indonesia and adapted to condition of students in Indonesia so that they can achieve national education goals listed in the Preamble to the Act The foundation of 1945 is to educate life nation. In addition, the curriculum as well developed accordingly era so that Indonesian students can compete with students all over the world. The current curriculum in Indonesia this is Curriculum 2013. In Minister of Education and Culture No. 24 of 2016 concerning Core Competencies and Basic Competencies, it is stated that the Core Competencies include spiritual attitude competence, attitude competence social competence, knowledge competency, and competence Skills. The four required competencies owned by each student adapted to the demands of the times based on the competencies to be achieved by 21st century learners. 21st century competencies meant is the ability to be developed in that learning includes critical thinking skills and problem solving, communication skills and collaboration, as well as creativity and innovation (Azzanie & Arroida, 2018)**.** Core competencies and basic competencies that has been prepared is used as basis in the preparation of textbooks. Therefore, textbooks are a must contains core competencies and basic competencies complete, must comply with the conditions students and keep abreast of developments era. Textbooks are used for references for each subject, including in in it for mathematics. Mathematics according to Gagne (Azzanie & Arroida, 2018)**.** It consists of two objects, namely the direct object and the indirect object; facts, concepts, and principles included in the inner direct object learning mathematics while investigative abilities problem solving ability is the object indirectly in learning mathematics. A good math textbook besides having to be in accordance with the core competencies and basic competencies, must also contain facts, correct concepts, principles, as well as in them load troubleshooting (Azzanie & Arroida, 2018)**.**

The role of education is very important in educating the nation's life in accordance with the Preamble of the 1945 Constitution. As an initial step to catch up on the backwardness in the field of education, the government pays serious attention to improving the quality of education (Aprima & Sari, 2022). Over time, a government policy has undergone improvements or changes, one of which is in the curriculum. This aims to improve the quality of education by changing the 2013 curriculum to an independent curriculum that can create active and creative learning. Minister of Education and Culture Nadiem Anwar Makarim stated that strengthening student character education can be done from the Ministry of Education and Culture policies implemented through various strategies centered on efforts to realize Pancasila Students (Ismail, et al., 2021). The Pancasila Student Profile is a profile of graduates with the hope that students will be able to realize the character and competencies that have been achieved. This is in line with the vision of

Indonesian Education, which is to create an advanced Indonesia that is sovereign, independent, and has personality through the creation of Pancasila Students. Indonesia is a country based on Pancasila. Pancasila that formed is the crystallization of the original values that exist within the Indonesian nation. Therefore the character of citizens who are expected and aspired to is the character of a Pancasilaist citizen. The formation of the character of Indonesian citizens in formal education (school) in accordance with the mandate of Law No 20 of 2003 concerning the National Education System, which is to shape the character of students which educates the life of the nation and develops Indonesian people as a whole. The context of being fully human is a citizen who has faith as well piety to God Almighty, have noble character, have knowledge and skills, physically and mentally healthy, good personality, able to be independent as well responsible

Pancasila students embody Indonesian students who have competence and behave according to Pancasila values. The Pancasila student profile consists of 6 dimensions, namely; 1) Faithful, pious to God Almighty, and noble; 2) Global Diversity; 3) Mutual Cooperation; 4) Independent; 5) Critical reasoning; and 6) Creative. Formation of the Pancasila Student Profile has the aim of being able to shape the character of students in learning (Sufanti & Nasucha, 2021). In its application, achieving optimal results is accompanied by support from learning components, one of which is teaching materials used by educators (Syafitri, 2023). Student interest in learning activities is strongly influenced by the support of learning resources, school facilities, and infrastructure, namely the existence of textbooks which are the implementation of the curriculum (Asri, 2019). The teacher has a very important role in increasing and adjusting students' absorption with the existence of the textbook (Alfulaila, 2022). Critical reasoning can be used by Indonesian students in developing themselves and facing challenges, this can be done in making wise decisions by considering relevant facts and data (Zuriah & Sunaryo, 2022; Güner & Gökçe, 2021)). The existence of critical thinking plays an important role in solving difficult problems and being able to produce innovation (Sulaiman & Azizah, 2020). It is very important for students to have the ability to reason critically in facing challenges, solving problems, and making wise decisions in the era of globalization. According to Krulik in Rahmawati, et al., (2023), that the activity of critical reasoning is the ability to reason critically. It can be concluded that critical reasoning is the ability to critically analyze, evaluate, and question information, arguments, or opinions with the aim of understanding issues more deeply. This ability must be possessed by students as a provision in catching up with what is currently implemented in the Merdeka Curriculum (Heri & Zaini, 2021). There are several reasons for the need to establish a culture of critical thinking in society. One of them is to face such a changing world rapidly that new knowledge always emerges every day, while old knowledge is organized and re-explained. In this era of rapid change, the main priority of an education system is to educate children on how to learn and think critically (Muhfahroyin, 2009). Some characteristics of the knowledge age are; 1) life, society, and economy become more

complex; 2) jobs are diminishing, compared to the previous era; and 3) science and information, land, labor and capital as the most important inputs in the modern production system. Wilson, 2000 in Muhfahroyin (2009) suggests several reasons about the need for reasonning thinking skills, namely; 1) knowledge based on memorization discredited; individual will not be able to save knowledge in their memory for future use; 2) information spread expanded so rapidly that each individual needs abilities that can be channeled so that they can recognize various kinds of internal problems different contexts at different times during their lifetime; 3) the complexity of the work Modern society demands a staff of capable thinkers demonstrate understanding and make decisions in the world of work; and 4) modern society requires individuals to combine information from various sources and make decisions.

In this research, mathematics books for senior high school grade XI were selected which were published by the Ministry of Education and Culture of the Republic of Indonesia with the first edition published in 2021 with the authors Al Azhary Masta, Yosep Dwi Kristanto, Elyda Yulfiana, and Muhammad Taqiyuddin. In the book, there is one element of the Pancasila student profile, namely critical reasoning, which is the provision for Indonesian students, especially phase E at the SMA/SMK level, aged 16-18 in an effort to develop themselves and face challenges in the 21st century. The SMA level in the Merdeka Curriculum no longer exists majors, so students must determine specialization lessons in class XI and class XII according to their talents and future careers. It is hoped that the application of critical reasoning elements in the book will dominate each chapter of the material so that Indonesian students are able to make the right decisions in dealing with various problems in the learning environment or in real life. The book is a reference for teachers and students prepared by the Government in the context of implementing the Independent Curriculum.

Previous research on the analysis of high school mathematics student books has been carried out by many previous studies. Kurniawati, et al., (2022) in her research discussed the quality of grade XI vocational mathematics textbooks Curriculum 2013 revised edition of 2017 based on the scientific approach. Munawwarah, et al., (2022) in his research analyzed the mathematics book for class XII SMA of the 2013 Curriculum group. Kurniawati, et al., (2022) in her research analyzed the level of conformity of class X specialization mathematics textbooks used by public high schools in Kutai Kartanegara Regency with the formulation of the 2013 curriculum. Sirait, et al. (2023) in their research will find out the types of errors in mathematics textbooks for grade XI SMA/MA Curriculum 2013. The results of Hartatik's research, et al. (2022) show that the high school mathematics book Class XII, published by the Ministry of Education and Culture on the topic of the third dimension, still does not meet the criteria of the independent curriculum and needs to be revised. Although research on the analysis of high school mathematics books has been carried out a lot and is still focused on the 2013 Curriculum, so researchers will conduct a different and still recent

analysis by choosing to use advanced high school mathematics books that will be used in the Independent Curriculum.

Based on the results of an interview with one of the high school teachers students still have difficulty in critically analyzing complex and abstract problems. The tendency of students is still to solve problems that are classified as simple so students' opportunities to develop critical reasoning skills are still limited. In line with the opinion of Lestari & Roesdiana, (2021) that students' critical reasoning skills are still in the low category. Even though the latest book published by the government is considered to have met the criteria for the Merdeka Curriculum, there are still few students who can interpret the dimensions of critical reasoning. Hartatik et al.'s research (2022) still focuses on analyzing high school books, which are only one chapter, with the result that the book does not meet the criteria of the Merdeka Curriculum. Based on previous research and the phenomena that occur, researchers are interested in analyzing the first printed book used in the Merdeka Curriculum, namely advanced high school mathematics books with a focus on critical reasoning dimensions. Therefore, the researcher raised the title "Analysis of Advanced Mathematics Books Based on the Values of the Pancasila Student Profile in the Critical Reasoning Dimension". The novelty of this research is to analyze each chapter presented in the book with a research focus on the values of the Pancasila Student Profile which is adjusted to the elaboration of the elements of critical reasoning for the Merdeka Curriculum. The purpose of this study is to analyze the book and provide input as a consideration in improving the advanced high school mathematics student book Merdeka Curriculum. Researchers not only look at the weaknesses of the student book, but researchers provide recommendations regarding the perfection of the Merdeka Curriculum student book so that it can support education and improve the quality of education in Indonesia.

METHOD

This research used a qualitative research method with a descriptive approach. This method was chosen because this research has the purpose to provide an in-depth description of the results of the value analysis of the critical reasoning dimension contained in the Advanced Mathematics book based on the Pancasila Profile. This research uses two sources of data, namely primary data and secondary data. The primary data in this study are words, sentences, or expressions that show and contain the Pancasila Student Profile on the critical reasoning dimension. For example, researchers will look for quotes in the book that show critical reasoning, reflection, analysis, or evaluation involving Pancasila values. Secondary data in this study are in the form of articles, journals, and relevant previous research theories. This secondary data is used to enrich references and strengthen research results.

One of the elements of the Pancasila Student Profile values, namely the dimension of critical reasoning, is the object of research in the analysis of Advanced Mathematics books.

The dimensions of critical reasoning include the ability to think logically, analytically, creatively, reflectively, and evaluatively. This research focuses on the analysis and description of these values in the context of the book. The subject of this research is the Advanced Mathematics book published by the Ministry of Education and Culture of the Republic of Indonesia. This research analyzes and describes the values of critical reasoning contained in the book, and to what extent the book encourages the development and application of critical reasoning in students. Data collection techniques are carried out by reading and recording information that is relevant to the research objectives. The Advanced mathematics book is read carefully and noted in every section related to the dimensions of critical reasoning based on the Pancasila Profile.

RESULT AND DISCUSSION

The Pancasila student profile values contained in all chapters in the Ministry of Education and Culture's Advanced Mathematics book for class XI consist of the dimension of faith and piety to God Almighty, the dimension of global diversity, the dimension of mutual cooperation, the dimension of independence, the dimension of critical reasoning, and the creative dimension. Pancasila students who think critically are able to objectively process both qualitative and quantitative information, build interest between various information, analyze information, evaluate and draw conclusions. The elements of critical thinking are obtaining and processing information and ideas, analyzing and evaluating reasoning, reflecting on thoughts and thinking processes in taking ideas (Head of Standards Agency, 2022).

1. Raises an Intriguing Question

The dimension of critical reasoning in Chapter 1 (Complex numbers) found on page 30 is presented after definition 1.6 of the conjugate of complex numbers about the possibility of a complex number $z = x + iy$ having the same conjugate. If this exists, students will be encouraged to think critically in determining the conditions for a complex number that is the same as its conjugate.

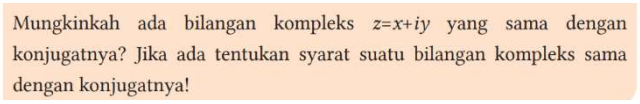

Mungkinkah ada bilangan kompleks $z=x+iy$ yang sama dengan konjugatnya? Jika ada tentukan syarat suatu bilangan kompleks sama dengan konjugatnya!

Figure 1: Intriguing Questions

The discussion in Chapter 1 (Complex numbers) on page 30 centers on the dimension of critical reasoning, which emerges after the introduction of definition 1.6, dealing with the conjugate of complex numbers. This particular section raises an intriguing question: Can a complex number z = x+iy have the same conjugate? The possibility of such a scenario prompts students to engage in critical thinking to determine the conditions under which a complex number can be equal to its conjugate.

Definition 1.6 introduces the concept of the conjugate of complex numbers. This is a fundamental concept in the study of complex numbers, as the conjugate is an essential

element for various operations and applications. The critical reasoning dimension in this chapter is sparked by the exploration of whether a complex number, represented as z = x + iy, can have the same conjugate. This raises a significant question that encourages students to think deeply about complex numbers. Critical thinking is vital in understanding the conditions under which a complex number is identical to its conjugate. Students are challenged to analyze and deduce these conditions, which may involve understanding the properties of complex conjugates. This discussion serves as a foundation for students to develop problem-solving skills and a deeper comprehension of complex numbers, as they critically investigate and identify the specific situations in which a complex number's conjugate is itself. In the end, this segment of Chapter 1 serves as a catalyst for critical thinking in the realm of complex numbers, fostering a deeper understanding of their properties and encouraging students to apply their reasoning skills to solve complex mathematical problems.

2. Deeper Understanding

The critical reasoning dimension in chapter 2 (Polynomials) found on page 58 about the algebraic form in example 2.1 part a (identifying the polynomial $4x^3y + 3x^2$) can be seen as subtracting the monomial $4x^3$ minus $3x^2$. Students are led to give opinions critically that polynomials are the sum of monomials.

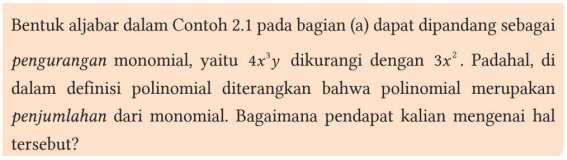

Bentuk aljabar dalam Contoh 2.1 pada bagian (a) dapat dipandang sebagai *pengurangan* monomial, yaitu $4x^3y$ dikurangi dengan $3x^2$. Padahal, di dalam definisi polinomial diterangkan bahwa polinomial merupakan *penjumlahan* dari monomial. Bagaimana pendapat kalian mengenai hal tersebut?

Figure 2: Leds to Give Opinions

The next dimension of critical reasoning is on page 65 about the relationship between degree polynomials and the maximum number of polynomial graphs that intersect the X-axis. This has been presented in the graphs of degree 0-5 polynomial functions before. On page 83 about the proof of $x^3 + 4x^2 + 5x + 8 = (x + 3)(x^2 + x + 2) + 2$, material related to mathematics at the college level is presented in a very relevant way in the critical reasoning column as as well as critical search for evidence in finding problem-solving ideas.

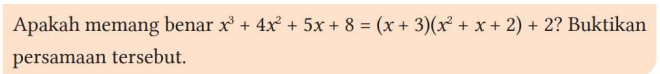
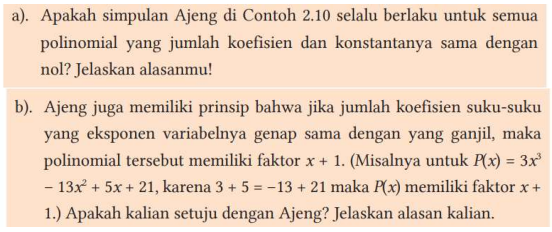

Apakah memang benar $x^3 + 4x^2 + 5x + 8 = (x + 3)(x^2 + x + 2) + 2$? Buktikan persamaan tersebut.

Figure 3: Critical Search for Evidence in Finding Problem-Solving Ideas

On pages 96-97 regarding example 2.19, the validity of factoring polynomials for all polynomials where the sum of the coefficients and constants equals zero, then regarding the statement that the sum of the coefficients of the terms whose variable exponents are even equal to the odd ones, then the polynomial has a factor $x + 1$. (For example, for $P(x) = 3x^3 - 13x^2 + 5x + 21$, because $3 + 5 = -13 + 21$then $P(x)$has a

factor of $x - 1$). The critical reasoning column on that page invites students to think, think, and analyze the truth of the polynomial statement.


a). Apakah simpulan Ajeng di Contoh 2.10 selalu berlaku untuk semua polinomial yang jumlah koefisien dan konstantanya sama dengan nol? Jelaskan alasanmu!

b). Ajeng juga memiliki prinsip bahwa jika jumlah koefisien suku-suku yang eksponen variabelnya genap sama dengan yang ganjil, maka polinomial tersebut memiliki faktor $x + 1$. (Misalnya untuk $P(x) = 3x^3 - 13x^2 + 5x + 21$, karena $3 + 5 = -13 + 21$ maka $P(x)$ memiliki faktor $x + 1$.) Apakah kalian setuju dengan Ajeng? Jelaskan alasan kalian.

Figure 4: Invites Students to Think and Analyze the Truth

The next critical reasoning column is on page 103 about the possibility of a polynomial in which all the coefficients and constants are real numbers have exactly one zero generator number that is not a real number. After working on the critical thinking column, an exercise on factors and zero generators of polynomials is presented which will help further mature students' knowledge about complex zero generators and polynomials.

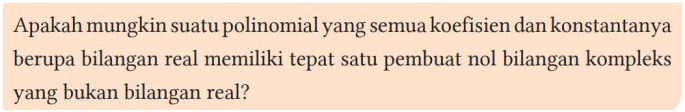

Apakah mungkin suatu polinomial yang semua koefisien dan konstantanya berupa bilangan real memiliki tepat satu pembuat nol bilangan kompleks yang bukan bilangan real?

Figure 5: Help Further Mature Students' Knowledge

The discussion in Chapter 2 (Polynomials) on page 58 introduces the critical reasoning dimension in a particular context, specifically focusing on example 2.1, part a. In this example, students are asked to identify the polynomial 4x^3y + 3x^2. Example 2.1, part a presents students with the polynomial 4x^3y + 3x^2, prompting them to dissect its structure and understand its composition. To facilitate this understanding, students are encouraged to break down the polynomial into its constituent parts. In this case, they are guided to see it as the subtraction of the monomial 4x^3 from 3x^2. This approach demonstrates a fundamental concept in polynomial algebra, where polynomials can be thought of as the sum or difference of monomials. In the given example, the polynomial is expressed as the difference between 4x^3 and 3x^2. Importantly, this concept encourages students to think critically about the nature of polynomials. They are led to form opinions that support the idea that polynomials are essentially comprised of monomials, and their understanding deepens as they apply this concept to the given example. In summary, the critical reasoning dimension in this section of Chapter 2 fosters a deeper understanding of polynomial algebra. By breaking down the given polynomial into its components, students learn to see polynomials as combinations of monomials, enhancing their ability to manipulate and analyze polynomial expressions effectively. This critical thinking approach is fundamental in mastering the topic of polynomials.

3. Thinking Critically About the Nature

The dimensions of critical reasoning in chapter 3 (Matrix) are found on page 145 beginning with the question of the applicability of the properties of the matrix addition operation. Students are led to think critically about the nature of the matrix subtraction operation which is carried out with several properties of addition matrix operations, then the following material regarding matrix reduction is analyzed, so that the conclusion is obtained in the critical reasoning column.

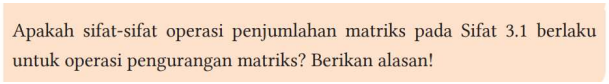
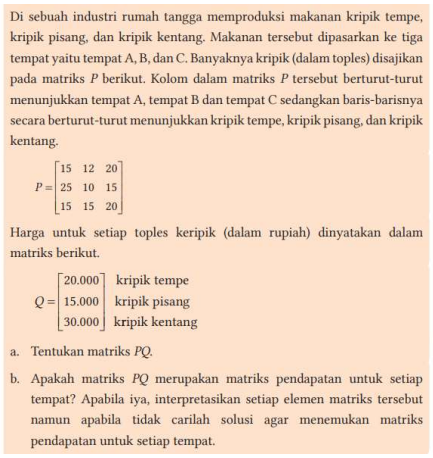

Apakah sifat-sifat operasi penjumlahan matriks pada Sifat 3.1 berlaku untuk operasi pengurangan matriks? Berikan alasan!

Figure 6: Led to Think Critically About the Nature

On page 150 regarding the interpretation of each element of the matrix, a daily contextual story is presented about the implementation of the matrix in the home industry of tempe, banana and potato chips. After the implementation critical thinking column, the properties of the multiplication of two matrices are presented and followed by a critical thinking column regarding the question whether the multiplication of two matrices is commutative.


Di sebuah industri rumah tangga memproduksi makanan kripik tempe, kripik pisang, dan kripik kentang. Makanan tersebut dipasarkan ke tiga tempat yaitu tempat A, B, dan C. Banyaknya kripik (dalam toples) disajikan pada matriks P berikut. Kolom dalam matriks P tersebut berturut-turut menunjukkan tempat A, tempat B dan tempat C sedangkan baris-barisnya secara berturut-turut menunjukkan kripik tempe, kripik pisang, dan kripik kentang.

$$P = \begin{bmatrix} 15 & 12 & 20 \\ 25 & 10 & 15 \\ 15 & 15 & 20 \end{bmatrix}$$

Harga untuk setiap toples keripik (dalam rupiah) dinyatakan dalam matriks berikut.

$$Q = \begin{bmatrix} 20.000 \\ 15.000 \\ 30.000 \end{bmatrix} \begin{matrix} \text{kripik tempe} \\ \text{kripik pisang} \\ \text{kripik kentang} \end{matrix}$$

a. Tentukan matriks PQ.

b. Apakah matriks PQ merupakan matriks pendapatan untuk setiap tempat? Apabila iya, interpretasikan setiap elemen matriks tersebut namun apabila tidak carilah solusi agar menemukan matriks pendapatan untuk setiap tempat.

Figure 7: Thinking Critically with Daily Contextual Story

The discussion in Chapter 3 (Matrix) on page 145 introduces the dimensions of critical reasoning, primarily centered around the operations and properties of matrices. The discussion commences with a fundamental question concerning the applicability of the properties associated with matrix addition operations. This sets the stage for exploring the properties and principles that govern the addition of matrices. Students are prompted to think critically about how these properties operate in the context of matrix algebra. Building on the understanding of matrix addition, students are then encouraged to engage in critical thinking about the nature of matrix subtraction. This operation is analyzed by applying the same properties and principles used for matrix addition, helping students draw connections between the two operations and deepen their understanding of matrix algebra. The discussion subsequently shifts to the topic of

matrix reduction, where matrices are manipulated and transformed to arrive at a specific conclusion. Students are guided through the critical analysis and problem-solving processes required for matrix reduction.

In summary, this section of Chapter 3 emphasizes the importance of critical reasoning in the study of matrices. Starting with matrix addition, students are led to think critically about matrix operations and their properties. The subsequent exploration of matrix subtraction and reduction further deepens their understanding. The "Critical thinking" column serves as a valuable tool to facilitate the development of problem-solving and analytical skills in the context of matrix algebra, ultimately enhancing students' proficiency in working with matrices.

4. Obtain and Process Information and Ideas

The critical reasoning dimension in chapter 4 (Geometry Transformation) is found on page 191, drawing questions regarding the definitions previously presented regarding formulas for other lines with more complex equations, for example in the formula for determining a map of the reflection of the line $y = 2x$. Then proceed with proving the general formula for reflecting the line $ax + by + c = 0$. The critical thinking column sessions lead students to obtain and process information and ideas, analyze, evaluate reasoning, and reflect on their own thoughts. The column let's think critically next is on page 195 regarding determining the line map $ax + by + c = 0$ which is translated by a vector which makes students experiment with reference to the previous example. The column let's think critically further on page 198 regarding the general determination of the line map $y = kx, k \in R$ which is rotated about the origin (0,0) by 90°. Determining a formula from specific to general is one of the steps for critical thinking. The section on finding a map of a reflection with a matrix is presented with a guided critical thinking column.

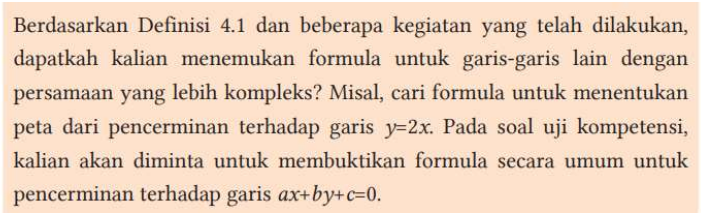
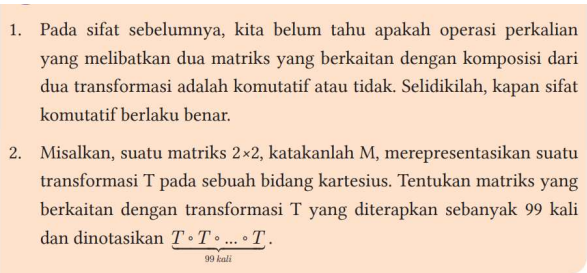

Berdasarkan Definisi 4.1 dan beberapa kegiatan yang telah dilakukan, dapatkah kalian menemukan formula untuk garis-garis lain dengan persamaan yang lebih kompleks? Misal, cari formula untuk menentukan peta dari pencerminan terhadap garis $y=2x$. Pada soal uji kompetensi, kalian akan diminta untuk membuktikan formula secara umum untuk pencerminan terhadap garis $ax+by+c=0$.

Figure 8: Determining a Formula From Specific to General

The next critical thinking column is on page 218 regarding the investigation of the nature of multiplication operations involving two matrices relating to the composition of the two transformations whether they have commutative properties, and questions regarding matrices related to the T transformation.



1. Pada sifat sebelumnya, kita belum tahu apakah operasi perkalian yang melibatkan dua matriks yang berkaitan dengan komposisi dari dua transformasi adalah komutatif atau tidak. Selidikilah, kapan sifat komutatif berlaku benar.
2. Misalkan, suatu matriks 2×2, katakanlah M, merepresentasikan suatu transformasi T pada sebuah bidang kartesius. Tentukan matriks yang berkaitan dengan transformasi T yang diterapkan sebanyak 99 kali dan dinotasikan $\underbrace{T \circ T \circ \ldots \circ T}_{99 \text{ kali}}$.

Figure 9: Investigation of The Nature of Multiplication Operations

The discussion in Chapter 4 (Geometry Transformation) on page 191 introduces the critical reasoning dimension, focusing on transformations and formulas for lines with more complex equations. The chapter initiates with questions about the definitions previously presented, particularly regarding formulas for lines with more intricate equations. An example is given, such as the formula for determining a map for the reflection of the line y = 2x. This engages students in exploring the practical application of geometric transformations.

Subsequently, the chapter progresses to proving a general formula for reflecting lines in the form ax + by + c = 0. This endeavor requires students to think critically about the principles underlying the reflection process and to formulate a comprehensive and versatile formula that applies to various line equations. The "Critical thinking" column sessions guide students through the process of obtaining, processing, and analyzing information and ideas. They encourage students to evaluate the reasoning behind the formulas and reflect on their thought processes as they work through the geometry transformations. A section on finding a map of reflection with a matrix is presented, accompanied by a guided critical thinking column. This section introduces students to the use of matrices in geometric transformations, emphasizing the practical application of mathematical tools in solving real-world problems. The subsequent "Critical thinking" column on page 218 focuses on the investigation of multiplication operations involving two matrices, particularly in the context of the composition of two transformations. Students are prompted to evaluate whether these transformations exhibit commutative properties and are presented with questions related to matrices and the T transformation.

In summary, this section of Chapter 4 promotes critical reasoning and problem-solving skills in the context of geometry transformations. It challenges students to derive general formulas from specific instances, encourages them to apply mathematical concepts to real-world scenarios, and highlights the practical applications of mathematics in solving problems related to geometric transformations. The "Critical thinking" columns offer valuable guidance in this process, helping students to develop a deeper understanding of the material.

5. Make Students Think that Everyday Phenomena are Mathematics

The dimensions of critical reasoning in chapter 5 (Functions and Modeling) are found on page 297 where the column is the implementation of functions and modeling with everyday phenomena which will make students think that everyday phenomena are mathematics. The next column is a modeling application for solar phenomena that participates in competitions with three activities: cycling, swimming and running.

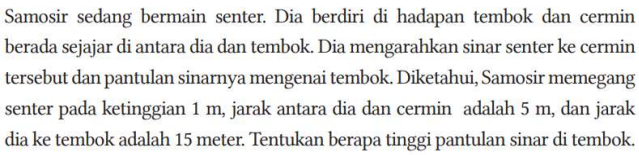

Samosir sedang bermain senter. Dia berdiri di hadapan tembok dan cermin berada sejajar di antara dia dan tembok. Dia mengarahkan sinar senter ke cermin tersebut dan pantulan sinarnya mengenai tembok. Diketahui, Samosir memegang senter pada ketinggian 1 m, jarak antara dia dan cermin adalah 5 m, dan jarak dia ke tembok adalah 15 meter. Tentukan berapa tinggi pantulan sinar di tembok.

Figure 10: Implementation of Functions and Modeling with Everyday Phenomena

The discussion in Chapter 5 (Functions and Modeling) on page 297 centers around the dimensions of critical reasoning, particularly within the context of functions and modeling. The chapter begins with an exploration of the implementation of functions and modeling with everyday phenomena. This introduction serves as a bridge between abstract mathematical concepts and the real world. It encourages students to recognize that everyday phenomena can be understood and analyzed through mathematical models and functions. The primary objective is to help students realize the relevance and applicability of mathematics in their daily lives. By showcasing how mathematical modeling can be used to explain and predict real-world phenomena, students are encouraged to develop a deeper appreciation for the subject. The subsequent "Critical thinking" column serves as a practical example of modeling application for solar phenomena. This application involves participation in competitions with three activities: cycling, swimming, and running. Students are challenged to apply their modeling skills to analyze and optimize performance in these activities. This modeling exercise encourages students to think critically and apply mathematical concepts to real-life scenarios. They are prompted to formulate models, make predictions, and make decisions based on the mathematical insights they have gained. By participating in the modeling competition, students not only gain a deeper understanding of mathematical modeling but also develop problem-solving and critical thinking skills that are essential in a wide range of real-world contexts.

Chapter 5 emphasizes the practical applications of mathematics through functions and modeling. The dimensions of critical reasoning are highlighted by showcasing how mathematical concepts can be used to analyze and improve real-world situations. This approach aims to bridge the gap between theoretical mathematics and practical problem-solving, fostering a deeper understanding of the subject while encouraging students to recognize the ubiquity of mathematics in everyday life.

Overall, all chapters in the Ministry of Education and Culture's Advanced Mathematics book for class XI are in accordance with the Ministry of Education and Culture's vision and mission contained in the Minister of Education and Culture Regulation

Number 22 of 2020 concerning the Strategic Plan of the Ministry of Education and Culture for 2020-2024 which reads "Pancasila students are the embodiment of students Indonesia as a lifelong student who has global competence and behaves in accordance with Pancasila values, with six main characteristics: faith, fear of God Almighty, and noble character, global diversity, mutual cooperation, independent, critical reasoning, and creative" (Ristiani, Wardana, & Purnamasari, 2022). This book is very relevant and encourages students to think critically by presenting various problem solutions, and there is also a special column entitled "Let's Think Critically" in each chapter which leads students to think critically in understanding various advanced issues. This teaching material published in 2021 has drawbacks, namely the critical thinking column in each chapter has a different serving size or does not have the same amount of presentation in each chapter. This is due to the level of difficulty of each chapter is different. What's more, this book has been able to support the vision of the Indonesian nation as embodied in the ESD criteria so that teaching materials can be said to be a good support in forming a nation's generation that has a Pancasila student profile if it is properly optimized in its use.

The difference this research with previous studies is that there is no comprehensive discussion of the dimensions of critical reasoning in advanced high school mathematics book before. Several previous researches were concerned with some of film, elementary school book, short story and etc. Some researches' title are such as the analysis of creative dimensions at Kebondalem Elementary School (Olivia yana, prasena ariyanto, 2022), analysis of Pancasila student profiles in science teaching materials (Lingkungan, Mendukung, & For, 2023), analysis of the value of Pancasila student profiles in the short stories Karyamin's smile and the laughter of the padang trash girl by Ahmad Tohari (Syaidah, Handayani, & Mirna, 2022), the influence of Pancasila student profile video media on the character of student independence in the new Muhammadiyah 1 Vocational High School (Rifa'i, Zuriah, & Lutfiana, 2022), analysis of the profile of Pancasila student elements of critical reasoning in the literacy and numeracy student learning module at the elementary school level (Ernawati & Rahmawati, 2022), analysis of the application of Pancasila student profiles in the formation of the character of students in elementary schools (Lubaba & Alfiansyah, 2022), analysis of the values of Pancasila student profiles in the film G30/spki for elementary school children (Ristiani, Wardana, & Purnamasari, 2022), analysis of strengthening the profile of Pancasila students through culture in elementary schools (Amalia, 2023), and construction of Pancasila student profiles in the teacher's handbook at school (Zuriah & Sunaryo, 2022).

Recommendations based on the results of the analysis of advanced high school books are to equate the number of critical thinking columns in each chapter so that there are not too many and too few numbers, so that the quantity of students learning in each chapter becomes the same or even more trained to always reason critically to success next school level or to university level. Another reason for the need for more critical reasoning is like the research

put forward by (Shalihah, 2021)in (Muhfahroyin, 2009) that to deal with such a changing world rapidly, new knowledge emerges every day, while old knowledge is organized and re-explained. In this age of rapid change, the first priority of an education system is teaching children how to learn and reasoning critically. The literature review research on Pancasila student profiles in the dimensions of critical reasonning in this book is relatively new because there is no research that discusses this matter before.

CONCLUSION

This book is very relevant and encourages students to think critically by presenting various problem solutions, and there is also a special column entitled "Let's Think Critically" in each chapter which leads students to think critically in understanding various advanced issues. This teaching material published in 2021 has drawbacks, namely the critical thinking column in each chapter has a different serving size or does not have the same amount of presentation in each chapter. This is probably due to the level of difficulty of each chapter. What's more, this book has been able to support the vision of the Indonesian nation as embodied in the ESD criteria so that teaching materials can be said to be a good support in forming a nation's generation that has a Pancasila student profile if properly optimized in its use. Recommendations based on the results of the analysis of advanced high school books are to equate the number of critical thinking columns in each chapter so that there are not too many and too few numbers, so that the quantity of students learning in each chapter becomes the same or even more trained to always reason critically to success next school level or to university level. Another reason for the need for more critical reasoning is like the research that to deal with such a changing world rapidly, new knowledge emerges every day, while old knowledge is organized and re-explained. In this age of rapid change, the first priority of an education system is teaching children how to learn and reasoning critically.

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