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Finding New Numbers From Square Matrix

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Abstract

Square matrix is a matrix whose number of rows = number of columns. Matrix algebra is a set of algebraic operations are valid on the set of matrices. Through the properties that apply matrix algebra can be found on the new numbers. The new number includes all the features of the theory of Abstract Algebra, namely: (1) is not empty, (2) is commutative, (3) associative, (4) there is an element of identity, and (5) there is an inverse element. The five properties in Algebra structure referred to as the properties of the group. Through these new numbers, the students were introduced to Complex Numbers are expressed in the form of a matrix.

The set of complex numbers is the parent of all the sets of numbers. On the set of complex numbers, students are introduced to the term numbers "imaginary" or the numbers "imaginary" is then symbolized by the letter i. Numbers imaginary / imaginary, arises from the needs of the equation when dealing with real numbers x^2 = - 1. Thus emerged the phenomenon of $i=\sqrt{-1}$. It can also be explored through a square matrix.

The result is expected as a reflection and recommendation for high school mathematics teachers/MA in strengthening the implementation of Curriculum2013.

Keywords: Matrices, complex numbers, matrixalgebra, learning, math.

Preliminary

Curriculum 2013 has come into effect in schools in Indonesia gradually. Curriculum 2013 is Competency-Based Curriculum (CBC) and also Education Unit Level Curriculum (SBC) because curriculum also be decentralized. There are four elements that undergo changes in the curriculumin 2013 compared with the previous curriculum. Elements of the proposed changes include Competency Standard (SKL), Content Standard (SI), Standard Process, and Standard Assessment.

In the 1984 curriculum, materials ever disajiikan complex numbers in SMA/MA majoring in science. The set of complex numbers is the parent of all the sets of numbers. On the set of complex numbers, students are introduced to the term numbers "*imaginary*" or the numbers "imaginary" is then symbolized by the letter i. Numbers imaginary/imaginary, arises from the needs of the equation when dealing with real numbers $x^2 = -1$. Thus emerged the phenomenon of $I = \sqrt{-1}$. These needs can be expressed in the form of a square matrix. Giving rise to the idea, for this number to introduce SMA/MA.

In mathematics curriculum in 2013, Matrix material presented on specialization Mathematics and Natural Sciences (MIA) class XII odd semester. Citing Curriculum 2006, Standard Competencies Using the concept of the material matrix is a matrix in solving problems with basic competencies include: (1) Using the properties and matrix operations to show that a square matrix is the inverse of the square matrix of an other, (2) Determine the determinant and inverse 2×2 matrix, and (3) Using the determinant and the inverse of the settlement system of linear equations in two variables.

For students, the phenomenon of imaginary numbers ($i=\sqrt{-1}$) is a new thing. Although the number of the rooth as been taught since grade X, even introduced in class

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IX SMP/MTs. To fix this understanding, the imaginary numbers as part of a complex number can be introduced through matrix algebra. So it is necessary to investigate the significance of matrix algebra learning in class XII SMA/MA to strengthen the implementation of the curriculum in 2013.

Special Purpose

In particular, the implementation of the study "Discovering a new number of a square matrix" is to improve the quality of processes and outcomes of learning mathematics. Through the implementation of this research grant is expected to:

1. Students better understand the number system.
2. Complex Numbers Students know the material as the parent of a number system.
3. Students are more skilled in performing operations on matrix algebra.

LITERATURE REVIEW

1. Matriks

According to SBC Syllabus 2006, matrix material given in class XII odd semester. Standard of Competence: using matrix concepts in problem solving. While the Basic Competencies include: (1) using the properties and matrix operations to show that a square matrix is the inverse of the square matrix of another, (2) determine the determinant and inverse matrix 2×2, and (3) using the determinant and inverse in progress system of linear equations of two variables.

Based on the syllabus, matrix materials include: Definition of Matrix, Notation and the Order Matrix, Types of Matrices, Similarities Two Matrices, Matrix Operations (addition, subtraction, multiplication, and powers), Determinants of Square Matrices and Inverse Matrices. Thus, the material discovered a new number of a square matrix can be pasted on the learning of Operations at Matrix.

2. StructureAlgebra

Leopold Kronecker (1823-1891) states: "*God made the original number, while other numbers of man-made*". Starting with the set of natural numbers to the operations of addition and multiplication, it can be shown how it can be extended to other systems that meet Aljbar properties are not satisfied by the natural numbers. A set with one or more operations on the set of the so-called algebraic structure. The set is called a basic set of the algebraic structure. Modern Algebra study the algebraic structures; and will be discussed in the next talks about the various types of algebraic structures consisting of a set F with two binary operations, usually written by + and ×, which satisfy some specific properties. We write algebraic structures such as $(F; +, \times)$ or $\langle F; +, \times \rangle$.

In relation to the definition of a particular structure, usually begins with understanding substructures (structural part). Substrukstur basic set of a set is a subset of the basic structure, and operations as tersebut. Structure for example, the set of complex numbers $\mathbb{C}$ load $\Re$ some set of real numbers as a subset of $\mathbb{C}$. Operations of addition and multiplication in the same $\mathbb{C}$ with operations in $\Re$, then $(\Re; +, \times)$ is a part of the structure $(\mathbb{C}; +, \times)$.

One important method of forming a new algebraic structure of the old structure is equivalent to understanding relationships. If (S, *) an algebraic structure consisting of a set S with a binary operation * on a set S, the equivalent relation ~ on S are called according to *, if a ~ b and c ~ d then a * b ~ c * d. The corresponding equivalent relationships will provide a new structure called the structure factor (quotient structure), with essentially set is the set of equivalent classes. For example strutur quotients of integers (B, +,.) The congruence relation modulu n is the set of integers modulo n (B_n, +,.).

3. Group

Group is a mathematical system. Mathematical system is a nonempty set equipped with an operation to her. So the group is a nonempty set equipped with a particular operation.

Definition 1:

Mathematical system (G, ×) is called a group if it satisfies: (1) the nature of associative, for any elements a, b, $c \in$ G, then apply $(ab)c = a(bc)$. (2) has a unit element. There is an element $e \in$ G that satisfies $ae = ea = a$ for all elements a in G. The element e is called the unit element, and (3) has an inverse element. For each $a \in$ G there is an element $a^{-1} \in$ G that satisfies $aa^{-1} = a^{-1}a = e$. Elements of a^{-1} is called the inverse element a. Further mathematical system (G, ×) is called a group G.

Definition 2:

Group G is called commutative if for every a, $b \in$ G applies $ab = ba$. A group said to be infinite if it contains infinitely many elements. Conversely if a group is said to contain many elements up. The number of elements contained in the group until the group level called symbolized t(G). In connection with unit element and inverse elements in the group, apply the following properties.

Properties 1:

A group G contains only one element of the unit.

Proof:

Let e and d states in the unit element of G. Then $e = ed = de = d$. Due to all the elements $g \in$ G force $g = ge = eg$ and $g = dg = gd$. So the group G have only one unit element, namely $e = d$.

Properties 2:

Every element in group G has only one inverse element.

Proof:

Suppose an element $a \in$ G has an inverse b and c. Then apply $ab = ba = e$ and $ac = ca = e$. Next we have: $b = be = b\,(ac) = (ba)\,c = ec = c$. So the element a has only one inverse.

Properties 3:

For every a, $b \in$ G force, $\left(a^{-1}\right)^{-1} = a$, dan $(ab)^{-1} = b^{-1}a^{-1}$.

Proof:

For a valid element of $aa^{-1} = a^{-1}a = e$. According to the *Properties* of 2, a^{-1} element has only one inverse. So. For elements a and b, by applying the associative properties, obtained by $(ab)(b^{-1}a^{-1}) = e$ and $(b^{-1}a^{-1})(ab) = e$. According to the nature of 2, the inverse element of a single ab, so $(ab)^{-1} = b^{-1}a^{-1}$.

From the definition 1 and the properties are complete, the following theorem can be derived.

Theorem 1:

Let G = (G, ×) a mathematical system that is associative, then the following equivalent statement:

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1. G a group.
2. A. There are $e\in$ G with properties $ae = a$ for all $a\in$ G.
2. B. For each $a\in$ G are $b\in$ G, which satisfy $ab = e$.

Proof:

(1 ➔ 2) clearly applies.

(2 ➔ 1) have known $ab=e$. Will prove that $ba=e$. For there is an element $b\in$G that satisfies c so that $bc=e$. Thus obtained: $ba=(ba)e=(ba)(bc)$ $=((ba)b)c=(b(ab))c=(be)c=bc=e$. Thus, for every $a\in$G are $b\in$G, which satisfy $ab=ba=e$. In this case $b= a^{-1}$.

Furthermore, known $ae = a$ for all $a\in$ G. Will proved $ea = a$. From the relations $ab = ba = e$ obtained $ea = (ab)a = a(ba) = ae = a$. So for all $a\in$ G applies $ae = ea = a$. Associative properties known to be valid. Thus G is a group.

DISCUSSION

Matrix symmetry/symmetrical matrix transposenya is equal to itself. If$A_{2\times 2}$ is a 2×2 matrix, the matrix is asymmetric matrix that satisfies $A=A^T$. While the skewed symmetry matrix is a matrix in the form$\begin{bmatrix} a & -b \\ b & a \end{bmatrix}$, with $a,b\in\Re$. Skewed symmetry matrix measuring 2×2 can meet the requirements as the number system. According to the structure of Algebra, a number is called a numeral system if the usual operation of addition and multiplication satisfy the usual properties: (1) is empty, (2) is commutative, (3) associative, (4) there is an element of identity, (5) and there is an element inverse. The five properties in Algebra structure referred to as the properties of the group.

Matrix$\begin{bmatrix} a & -b \\ b & a \end{bmatrix}$with $a,b\in\Re$ is the set of non-empty. This means that for every a,b$\in\Re$ we can form a matrix of symmetry tilted measuring 2×2. We take regardless of the value of a and b, as long as it still elements $\Re$, it will be our form of matrix symmetryitalic $\begin{bmatrix} a & -b \\ b & a \end{bmatrix}$.

Eg $\begin{bmatrix} a_1 & -b_1 \\ b_1 & a_1 \end{bmatrix}$ and $\begin{bmatrix} a_2 & -b_2 \\ b_2 & a_2 \end{bmatrix}$, then:

$$\begin{bmatrix} a_1 & -b_1 \\ b_1 & a_1 \end{bmatrix} + \begin{bmatrix} a_2 & -b_2 \\ b_2 & a_2 \end{bmatrix} = \begin{bmatrix} a_2 & -b_2 \\ b_2 & a_2 \end{bmatrix} + \begin{bmatrix} a_1 & -b_1 \\ b_1 & a_1 \end{bmatrix}$$

$$= \begin{bmatrix} a_1 + a_2 & -b_1 - b_2 \\ b_1 + b_2 & a_1 + a_2 \end{bmatrix}$$

$$= \begin{bmatrix} a_2 + a_1 & -b_2 - b_1 \\ b_2 + b_1 & a_2 + a_1 \end{bmatrix}$$

$$= \begin{bmatrix} a_1 + a_2 & -(b_1 + b_2) \\ b_1 + b_2 & a_1 + a_2 \end{bmatrix}$$

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$$= \begin{bmatrix} a_2 + a_1 & -(b_2 + b_1) \\ b_2 + b_1 & a_2 + a_1 \end{bmatrix}.$$

That is the sum of two symmetric matrices generating matrix skewed skewed symmetry as well. It also shows that the sum of the applicable skewed symmetry matrix commutative properties.

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Similarly to the usual multiplicati on operation, take 2 different oblique symmetry matrix, eg $\begin{bmatrix} a_1 & -b_1 \\ b_1 & a_1 \end{bmatrix}$ and $\begin{bmatrix} a_2 & -b_2 \\ b_2 & a_2 \end{bmatrix}$, then:

$$\begin{bmatrix} a_1 & -b_1 \\ b_1 & a_1 \end{bmatrix} \times \begin{bmatrix} a_2 & -b_2 \\ b_2 & a_2 \end{bmatrix} = \begin{bmatrix} a_1 \times a_2 + -b_1 \times b_2 & a_1 \times -b_2 + -b_1 \times a_2 \\ b_1 \times a_2 + a_1 \times b_2 & b_1 \times -b_2 + a_1 \times a_2 \end{bmatrix}$$
$$= \begin{bmatrix} a_1 a_2 - b_1 b_2 & -(a_1 b_2 + b_1 a_2) \\ b_1 a_2 + a_1 b_2 & a_1 a_2 - b_1 b_2 \end{bmatrix}$$
$$= \begin{bmatrix} a_1 a_2 - b_1 b_2 & -(a_1 b_2 + b_1 a_2) \\ a_1 b_2 + b_1 a_2 & a_1 a_2 - b_1 b_2 \end{bmatrix}.$$

In the same way, product from $\begin{bmatrix} a_2 & -b_2 \\ b_2 & a_2 \end{bmatrix} \times \begin{bmatrix} a_1 & -b_1 \\ b_1 & a_1 \end{bmatrix}$is $\begin{bmatrix} a_1 a_2 - b_1 b_2 & -(a_1 b_2 + b_1 a_2) \\ a_1 b_2 + b_1 a_2 & a_1 a_2 - b_1 b_2 \end{bmatrix}$. Tilted so that the matrix symmetry applies to the commutative properties of multiplication.

Grab three different oblique symmetry matrix, eg. $\begin{bmatrix} a_1 & -b_1 \\ b_1 & a_1 \end{bmatrix}$, $\begin{bmatrix} a_2 & -b_2 \\ b_2 & a_2 \end{bmatrix}$, and $\begin{bmatrix} a_3 & -b_3 \\ b_3 & a_3 \end{bmatrix}$. It can easily be shown that $\begin{bmatrix} a_1 & -b_1 \\ b_1 & a_1 \end{bmatrix} + \left\{ \begin{bmatrix} a_2 & -b_2 \\ b_2 & a_2 \end{bmatrix} + \begin{bmatrix} a_3 & -b_3 \\ b_3 & a_3 \end{bmatrix} \right\} = \left\{ \begin{bmatrix} a_1 & -b_1 \\ b_1 & a_1 \end{bmatrix} + \begin{bmatrix} a_2 & -b_2 \\ b_2 & a_2 \end{bmatrix} \right\} + \begin{bmatrix} a_3 & -b_3 \\ b_3 & a_3 \end{bmatrix}$. This suggests that the skewed symmetry matrix applicable to the sum and associative properties of multiplication.

In the skewed symmetry matrix$\begin{bmatrix} a & -b \\ b & a \end{bmatrix}$with $a,b \in \Re$, if $a = b = 0$, the obtained matrix $\begin{bmatrix} 0 & 0 \\ 0 & 0 \end{bmatrix}$ so apply $\begin{bmatrix} a & -b \\ b & a \end{bmatrix} + \begin{bmatrix} 0 & 0 \\ 0 & 0 \end{bmatrix} = \begin{bmatrix} 0 & 0 \\ 0 & 0 \end{bmatrix} + \begin{bmatrix} a & -b \\ b & a \end{bmatrix} = \begin{bmatrix} a & -b \\ b & a \end{bmatrix}$. This suggests the existence of the identity element in the matrix summation skewed symmetry. Similarly, there is a unit matrix $\begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$ so apply $\begin{bmatrix} a & -b \\ b & a \end{bmatrix} \times \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix} = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix} \times \begin{bmatrix} a & -b \\ b & a \end{bmatrix} = \begin{bmatrix} a & -b \\ b & a \end{bmatrix}$. This suggests the existence of an element of the identity matrix multiplication on oblique symmetry.

To indicate the presence of elements of the inverse of the sum, it can be demonstrated through:$\begin{bmatrix} a & -b \\ b & a \end{bmatrix} + A = \begin{bmatrix} 0 & 0 \\ 0 & 0 \end{bmatrix}$, then obtained $A = \begin{bmatrix} -a & b \\ -b & -a \end{bmatrix}$which is also the skewed symmetry matrix. So$\begin{bmatrix} -a & b \\ -b & -a \end{bmatrix}$is an element of the inverse of the sum. Similarly, in determining the multiplicative inverse element. Note that $\begin{bmatrix} a & -b \\ b & a \end{bmatrix} \times A = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$. Then:

$$\begin{bmatrix} a & -b \\ b & a \end{bmatrix} \times A = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$$

$$\frac{1}{a^2-(-b^2)} \times \begin{bmatrix} a & b \\ -b & a \end{bmatrix} \times \begin{bmatrix} a & -b \\ b & a \end{bmatrix} \times A = \frac{1}{a^2-(-b^2)} \times \begin{bmatrix} a & b \\ -b & a \end{bmatrix} \times \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}.$$

$$\frac{1}{a^2+b^2} \times \begin{bmatrix} a & b \\ -b & a \end{bmatrix} \times \begin{bmatrix} a & -b \\ b & a \end{bmatrix} \times A = \frac{1}{a^2+b^2} \times \begin{bmatrix} a & b \\ -b & a \end{bmatrix} \times \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}.$$

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$$\begin{bmatrix}\frac{a}{a^2+b^2} & \frac{b}{a^2+b^2}\\ \frac{-b}{a^2+b^2} & \frac{a}{a^2+b^2}\end{bmatrix}\times\begin{bmatrix}a & -b\\ b & a\end{bmatrix}\times A=\begin{bmatrix}\frac{a}{a^2+b^2} & \frac{b}{a^2+b^2}\\ \frac{-b}{a^2+b^2} & \frac{a}{a^2+b^2}\end{bmatrix}\times\begin{bmatrix}1 & 0\\ 0 & 1\end{bmatrix}.$$

$$\begin{bmatrix}\frac{a}{a^2+b^2}\times a+\frac{b}{a^2+b^2}\times b & \frac{a}{a^2+b^2}\times -b+\frac{b}{a^2+b^2}\times a\\ \frac{-b}{a^2+b^2}\times a+\frac{a}{a^2+b^2}\times b & \frac{-b}{a^2+b^2}\times -b+\frac{a}{a^2+b^2}\times a\end{bmatrix}\times A=$$
$$\begin{bmatrix}\frac{a}{a^2+b^2}\times 1+\frac{b}{a^2+b^2}\times 0 & \frac{a}{a^2+b^2}\times 0+\frac{b}{a^2+b^2}\times 1\\ \frac{-b}{a^2+b^2}\times 1+\frac{b}{a^2+b^2}\times 0 & \frac{-b}{a^2+b^2}\times 0+\frac{a}{a^2+b^2}\times 1\end{bmatrix}.$$

$$\begin{bmatrix}\frac{a^2}{a^2+b^2}+\frac{b^2}{a^2+b^2} & \frac{a\times -b}{a^2+b^2}+\frac{b\times a}{a^2+b^2}\\ \frac{-b\times a}{a^2+b^2}+\frac{a\times b}{a^2+b^2} & \frac{-b\times -b}{a^2+b^2}+\frac{a\times a}{a^2+b^2}\end{bmatrix}\times A=\begin{bmatrix}\frac{a}{a^2+b^2}+0 & 0+\frac{b}{a^2+b^2}\\ \frac{-b}{a^2+b^2}+0 & 0+\frac{a}{a^2+b^2}\end{bmatrix}.$$

$$\begin{bmatrix}\frac{a^2+b^2}{a^2+b^2} & \frac{-ab+ab}{a^2+b^2}\\ \frac{-ab+ab}{a^2+b^2} & \frac{b^2+a^2}{a^2+b^2}\end{bmatrix}\times A=\begin{bmatrix}\frac{a}{a^2+b^2} & \frac{b}{a^2+b^2}\\ \frac{-b}{a^2+b^2} & \frac{a}{a^2+b^2}\end{bmatrix}.$$

$$\begin{bmatrix}1 & 0\\ 0 & 1\end{bmatrix}\times A=\begin{bmatrix}\frac{a}{a^2+b^2} & \frac{b}{a^2+b^2}\\ \frac{-b}{a^2+b^2} & \frac{a}{a^2+b^2}\end{bmatrix}.$$

$$A=\begin{bmatrix}\frac{a}{a^2+b^2} & \frac{b}{a^2+b^2}\\ \frac{-b}{a^2+b^2} & \frac{a}{a^2+b^2}\end{bmatrix}.$$

So it can be proved that: $\begin{bmatrix}a & -b\\ b & a\end{bmatrix}\times A=A\times\begin{bmatrix}a & -b\\ b & a\end{bmatrix}=\begin{bmatrix}1 & 0\\ 0 & 1\end{bmatrix}$ with $A=\begin{bmatrix}\frac{a}{a^2+b^2} & \frac{b}{a^2+b^2}\\ \frac{-b}{a^2+b^2} & \frac{a}{a^2+b^2}\end{bmatrix}$.

$$\begin{bmatrix}a & -b\\ b & a\end{bmatrix}\times\begin{bmatrix}\frac{a}{a^2+b^2} & \frac{b}{a^2+b^2}\\ \frac{-b}{a^2+b^2} & \frac{a}{a^2+b^2}\end{bmatrix}=\begin{bmatrix}1 & 0\\ 0 & 1\end{bmatrix}.$$

$$\begin{bmatrix}a\times\frac{a}{a^2+b^2}+-b\times\frac{-b}{a^2+b^2} & a\times\frac{b}{a^2+b^2}+-b\times\frac{a}{a^2+b^2}\\ b\times\frac{a}{a^2+b^2}+a\times\frac{-b}{a^2+b^2} & b\times\frac{b}{a^2+b^2}+a\times\frac{a}{a^2+b^2}\end{bmatrix}=\begin{bmatrix}1 & 0\\ 0 & 1\end{bmatrix}.$$

$$\begin{bmatrix}\frac{a^2}{a^2+b^2}+\frac{b^2}{a^2+b^2} & \frac{a\times b}{a^2+b^2}-\frac{b\times a}{a^2+b^2}\\ \frac{b\times a}{a^2+b^2}+\frac{-b\times a}{a^2+b^2} & \frac{b^2}{a^2+b^2}+\frac{a^2}{a^2+b^2}\end{bmatrix}=\begin{bmatrix}1 & 0\\ 0 & 1\end{bmatrix}.$$

$$\begin{bmatrix} \frac{a^2+b^2}{a^2+b^2} & \frac{ab-ab}{a^2+b^2} \\ \frac{ba-ba}{a^2+b^2} & \frac{b^2+a^2}{a^2+b^2} \end{bmatrix} = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}.$$

$$\begin{bmatrix} 1 & \frac{0}{a^2+b^2} \\ \frac{0}{a^2+b^2} & 1 \end{bmatrix} = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}.$$

$$\begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix} = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}.$$

similarly $A \times \begin{bmatrix} a & -b \\ b & a \end{bmatrix} = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$ with $A = \begin{bmatrix} \frac{a}{a^2+b^2} & \frac{b}{a^2+b^2} \\ \frac{-b}{a^2+b^2} & \frac{a}{a^2+b^2} \end{bmatrix}$.

From the description above, it is clear that the skewed symmetry matrix$\begin{bmatrix} a & -b \\ b & a \end{bmatrix}$with $a,b \in \Re$ apply the properties of the group.So if the set formed $\mathbb{C} = \left\{\begin{bmatrix} a & -b \\ b & a \end{bmatrix},\ a, b \in \Re\right\}$ also fulfill the properties of the group.This is represented as the set ofcomplex numbers.

On the set $\mathbb{C} = \left\{\begin{bmatrix} a & -b \\ b & a \end{bmatrix},\ a, b \in \Re\right\}$there are elements$\begin{bmatrix} 1 & -1 \\ 1 & 1 \end{bmatrix}$which has the properties$\begin{bmatrix} 1 & -1 \\ 1 & 1 \end{bmatrix}^2 = \begin{bmatrix} 1 & -1 \\ 1 & 1 \end{bmatrix} \times \begin{bmatrix} 1 & -1 \\ 1 & 1 \end{bmatrix} = -\begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$. Thus the matrix has properties such as i, is $i^2 = -1$ [Budi, 2010]. This element is the answer of the equation $x^2 + 1 = 0$.

Form $\begin{bmatrix} a & -b \\ b & a \end{bmatrix}$ can be expressed as $a\begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix} + b\begin{bmatrix} 0 & -1 \\ 1 & 0 \end{bmatrix}$, which is a representation of the $a \times 1 + b \times i = a + bi$. Based on these results, then any matrix skewed symmetry can be described as a point or a vector that originate at (0, 0) and culminate in a point (a, b).The length of the vector or the modulus of a complex number can be obtained from$\begin{vmatrix} a & -b \\ b & a \end{vmatrix} = a^2 + b^2$. Furthermore, each matrix symmetry can be represented in the form of oblique:

$$\begin{bmatrix} a & -b \\ b & a \end{bmatrix} = \sqrt{a^2+b^2} \times \begin{bmatrix} \frac{a}{\sqrt{a^2+b^2}} & -\frac{b}{\sqrt{a^2+b^2}} \\ \frac{b}{\sqrt{a^2+b^2}} & \frac{a}{\sqrt{a^2+b^2}} \end{bmatrix} = \sqrt{a^2+b^2} \times \begin{bmatrix} Cos\ \theta & -Sin\ \theta \\ Sin\ \theta & Cos\ \theta \end{bmatrix}$$

with $\tan\theta = \frac{b}{a}$, and is called the argument of complex numbers.

From the description above, it is clear that$\begin{bmatrix} a & -b \\ b & a \end{bmatrix}$with $a,b \in \Re$is a number derived from the exploration of new square matrix2 × 2, these numbers satisfy the properties of Algebraic Structures. Further, that the complex numbers can be represented by a matrix algebra is$\begin{bmatrix} a & -b \\ b & a \end{bmatrix}$with $a,b \in \Re$. In theory, these numbers can be introduced (back) to the student MA/SMA. Given the specialization class XII syllabus of Mathematics Mathematics and Natural Sciences (MIA) students already studying the matrix material.

2. Implementation of the Curriculum 2013

In mathematical learning implementation steps that can be done as follows:

a. observe

The students are given a definition of the matrix. Then the students were asked to read and understand these definitions. May occur understanding of diverse learners according kemapuannya. From this situation, the teacher will lead the next phase, which is asking.

b. ask

At this stage, learners are given the opportunity to ask about the broadest definition of the matrix to the teacher.

c. Reasoning / Collecting Data

At this stage learners are guided to make examples of the definition of the matrix matrix. Then learners are guided to select which includes a square matrix and is not a square matrix.

d. Processing Data

Having obtained a square matrix examples, students are guided in the material matrix algebra, namely: summing, subtracting, multiplying, and powers.

e. Communicating

Of the material as it is understood, learners communicate material on matrix algebra matrix skewed symmetry. It is expected that learners can find the new numbers skewed symmetry of the matrix.

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