



CERTIFICATE OF APPRECIATION

3755/Un.08/FTK/PP.00.9/5/2024

This certificate is proudly presented to

Dr. Mahdalena, S.Pd, M.Pd

as **Presenter** at

The 1st International Conference

“The Application of Artificial Intelligence Technology in Math and Physics Learning”

held by Mathematics Education and Physics Education Department

Faculty of Tarbiyah and Teacher Training

UIN Ar-Raniry Banda Aceh

May 14 - 15, 2024

Banda Aceh, May 15, 2024



Prof. Safrul Muluk, S.Ag., M.A., M.Ed., Ph.D

Dean of Faculty of Tarbiyah and Teacher Training
UIN Ar-Raniry Banda Aceh

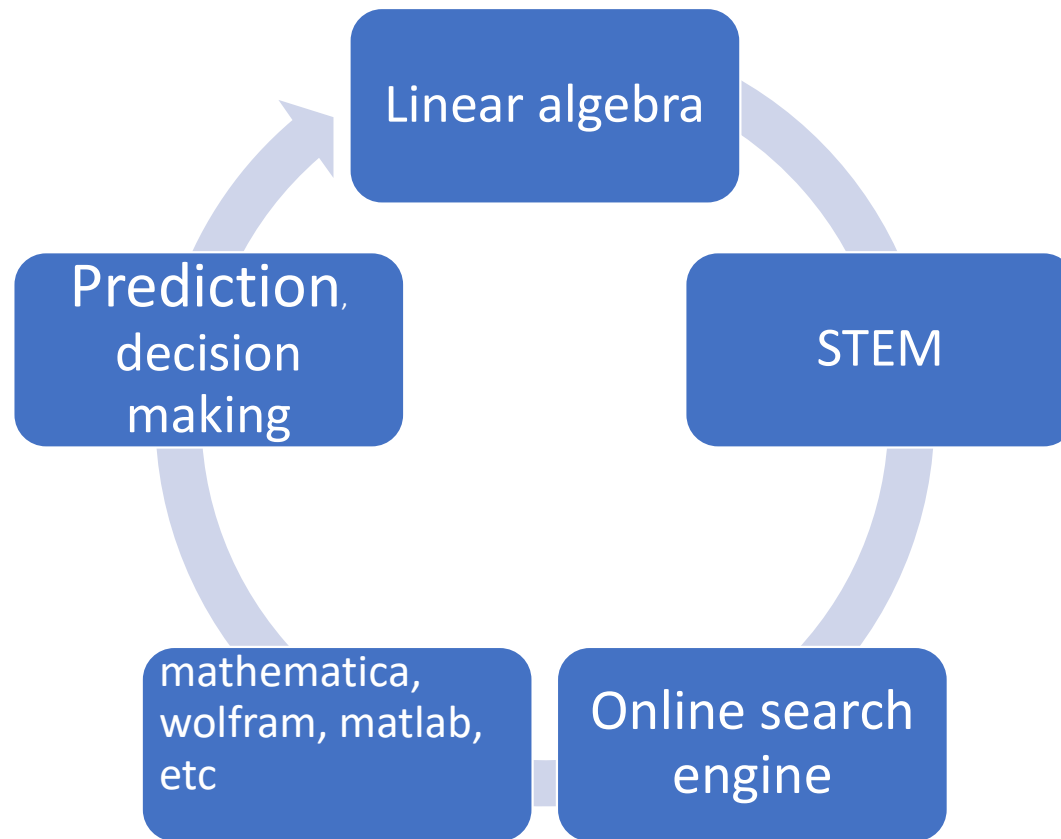
The 1st International Conference on Mathematics, and Physics Education 2024

Using Wolfram Alpha for Assistance in the Learning of Linear Algebra

Dr. Mahdalena, S.Pd, M.Pd

IAIN LHOKSEUMAWE

Introduction



Theoretical framework

1. <https://www.wolframalpha.com/>
2. Linear Algebra
3. Matrix Multiplication
4. Determinant
5. Systems of Linear Equations
6. Linear Independence and dependence

Method

Literature Study

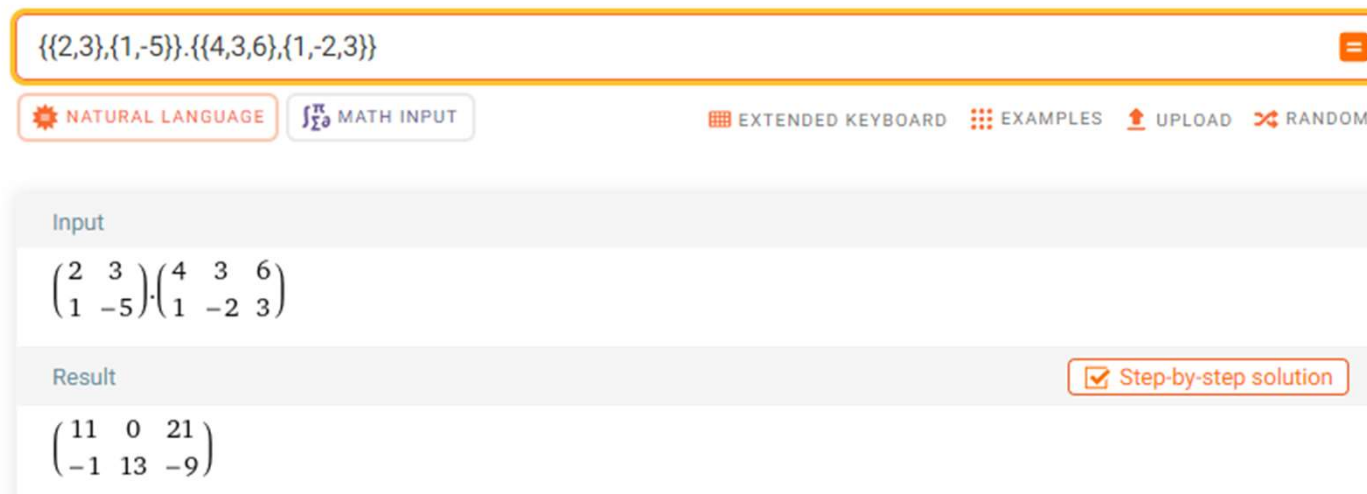
Data

1. David et al, Linear Algebra and its Application, 2016, Pearson Education, USA
2. Mark J.DeBonis , Introduction to Linear Algebra (Computation, Application and Theory), 2022, Taylor and Francis Group
3. Shou-Te Chang, Advanced Linear Algebra (With an Introduction to Module Theory), 2023, Singapore: Word Scientific Publishing

Result and discussion

1. Matrix Multiplication

Compute AB , where $A = \begin{pmatrix} 2 & 3 \\ 1 & -5 \end{pmatrix}$ and $B = \begin{pmatrix} 4 & 3 & 6 \\ 1 & -2 & 3 \end{pmatrix}$



The screenshot shows a web-based math solver interface. At the top, there is a search bar containing the input $\{\{2,3\},\{1,-5\}\}.\{\{4,3,6\},\{1,-2,3\}\}$. Below the search bar are several buttons: "NATURAL LANGUAGE" (with a gear icon), "MATH INPUT" (with a math symbol icon), "EXTENDED KEYBOARD" (with a keyboard icon), "EXAMPLES" (with a grid icon), "UPLOAD" (with an upload icon), and "RANDOM" (with a crossed-out icon). The main content area is divided into two sections: "Input" and "Result". The "Input" section displays the matrix multiplication $\begin{pmatrix} 2 & 3 \\ 1 & -5 \end{pmatrix} \cdot \begin{pmatrix} 4 & 3 & 6 \\ 1 & -2 & 3 \end{pmatrix}$. The "Result" section displays the resulting matrix $\begin{pmatrix} 11 & 0 & 21 \\ -1 & 13 & -9 \end{pmatrix}$. A "Step-by-step solution" button is visible in the bottom right corner of the result section.

2. Calculate the determinant of

$$\begin{bmatrix} 1 & 2 & -1 & 3 \\ 0 & 1 & 4 & 2 \\ 0 & 1 & 0 & 4 \\ 1 & 0 & 2 & 1 \end{bmatrix}$$

FROM THE MAKERS OF WOLFRAM LANGUAGE AND MATHEMATICA



det({{1,2,-1,3},{0,1,4,2},{0,1,0,4},{1,0,2,1}})

NATURAL LANGUAGE MATH INPUT EXTENDED KEYBOARD EXAMPLES UPLOAD RANDOM

Input interpretation

$$\begin{vmatrix} 1 & 2 & -1 & 3 \\ 0 & 1 & 4 & 2 \\ 0 & 1 & 0 & 4 \\ 1 & 0 & 2 & 1 \end{vmatrix}$$

Customize & Save Images determinant

Result

-30

Enlarge Data Customize Plain Text

3. Solve the linear system

$$2x + y - 2z + 3w = 1$$

$$3x + 2y - z + 2w = 4$$

$$3x + 3y + 3z - 3w = 5$$

Input: $2x + y - 2z + 3w = 1$, $3x + 2y - z + 2w = 4$, $3x + 3y + 3z - 3w = 5$

Output:



$2x + y - 2z + 3w = 1, 3x + 2y - z + 2w = 4, 3x + 3y + 3z - 3w = 5$



NATURAL LANGUAGE

MATH INPUT

EXTENDED KEYBOARD

EXAMPLES

UPLOAD

RANDOM

Input

$\{2x + y - 2z + 3w = 1, 3x + 2y - z + 2w = 4, 3x + 3y + 3z - 3w = 5\}$

Alternate forms

$\left\{z = \frac{3w}{2} + x + \frac{y}{2} - \frac{1}{2}, z = 2w + 3x + 2y - 4, z = w - x - y + \frac{5}{3}\right\}$

$\{3w + 2x + y = 2z + 1, 2w + 3x + 2y = z + 4, 3(-w + x + y + z) = 5\}$

Solutions

Enlarge

Data

Customize

Plain Text

(no solutions exist)

Download Page

POWERED BY THE WOLFRAM LANGUAGE

4. Linear Independence and dependence


Let E be the set of vectors

$$E = \{(0,1,0), (0,1,1), (0,0,1)\}$$

In \mathbb{R}^3 . Then E is a linearly dependent set of vectors because

$$1(0,1,0) + 1(0,0,1) + (-1)(0,1,1) = (0,0,0)$$

are $(0,1,0)$, $(0,1,1)$ and $(0,0,1)$ linearly independent?

 NATURAL LANGUAGE

 MATH INPUT

 EXTENDED KEYBOARD

 EXAMPLES

 UPLOAD

 RANDOM

Input interpretation

linear independence

$(0, 1, 0)$ | $(0, 1, 1)$ | $(0, 0, 1)$

Result

Step-by-step solution

$(0, 1, 0)$, $(0, 1, 1)$, and $(0, 0, 1)$ are linearly dependent

Subspace spanned

Show details

$\{(0, x + y, y) : x, y \in \mathbb{R}\}$

\mathbb{R} is the set of real numbers

Linear relation

$(0, 0, 1) + (0, 1, 0) - (0, 1, 1) = (0, 0, 0)$

Maximal linearly independent subset

$\{(0, 1, 0), (0, 1, 1)\}$

Conclusion

Wolfram Alpha is relatively easy to use and very effective in helping understanding and solving algebraic problems, both simple and complex.

Artificial intelligence (AI) technologies have made significant strides in the past ten years in handling challenging problems. Two areas of particular success have been computer vision and the creation of autonomous agents. At the moment, numerous facets of mathematical activity and mathematics education are beginning to include contemporary AI technology. One of the mathematics education curriculum's courses (MK) is linear algebra; since MK is applied widely in many different fields, it is crucial that MK learning be taught using AI applications. One such application is Wolfram Alpha (WA), which is fairly well-known due to its easy Google accessibility. As an example, let's say one of the topics is systems of linear equations (SPL), where each SPL can have exactly one solution, no solutions, or an infinite number of solutions. Any of the m linear equation systems with n unknown components in it Using OBE (elementary row operations), the solution can be found. Naturally, using WA would be a more intriguing method to determine whether the SPL has a solution or not, in addition to OBE. The purpose of this study is to describe the application of WA in various MK subjects related to linear algebra. An arbitrary system of m linear equations with n unknown variables OBE can be used to determine the solution. Naturally, WA would be a more intriguing method to determine whether the SPL has a solution than OBE.



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