**Introduction Aljabar (Elimination, Substitution, Determinant.)**

**Group 7**

* **Maulana Dwi Cahyono (2241720241/ No.15)**
* **Steven Christian Susanto (2241720003/ No. 26)**

1. **Elimination**
   1. Definition:

The elimination method is the process of eliminating one of the variables in the system of linear equations using the addition or subtraction methods in conjunction with multiplication or division of coefficients of the variables.

* 1. Usage:

Elimination is best used when both equations are in standard form (Ax + By = C).

* 1. How to use: (https://opentextbc.ca/businesstechnicalmath/chapter/solve-systems-of-equations-by-elimination/)
* Write both equations in standard form.
* Make the coefficients of one variable opposites.
* Add the equations resulting from Step 2 to eliminate one variable.
* Solve for the remaining variable.
* Substitute the solution from Step 4 into one of the original equations.
  1. Example:
* Solve this equation

4x + 3y = 21

2x - y = 3

* Match the number of constant with the same variable

4x + 3y = 21 => x1

2x - y = 3 => x2

4x + 3y = 21

4x - 2y = 6 -

5y = 15

y = 3

* Insert the y value into the 2nd equation

2x – y = 3

2x – 3 = 3

2x = 6

x = 3

* So the solution to this equation is x = 3 and y = 3.
* To check if the solution is correct we can insert the value into the original equations.

First equation:

4(3) + 3(3) = 21

12 + 9 = 21

21 = 21

Second equation:

2(3) – 3 = 3

6 – 3 = 3

3 = 3

* 1. Exercise:
* Problem 1:

2m – 3n = 2

5m + 2n = 24

Find the value of:

m – n = ?

* Problem 2:

4x + 3y = 2.500

2x + 7y = 2.900

Based on the equations is 2x + 2y = 1300 correct?

1. **Substitution**
   1. Definition:

In this method, we find the value of any one of the variables by isolating it on one side and taking every other term on the other side of the equation. Then we substitute that value in the second equation.

* 1. Usage:

Substitution is best used when one (or both) of the equations is already solved for one of the variables.

* 1. How to solve: (https://byjus.com/maths/substitution-method/)
* Simplify the given equation by expanding the parenthesis.
* Solve one of the equations for either x or y.
* Substitute the step 2 solution in the other equation.
* Now solve the new equation obtained using elementary arithmetic operations.
  1. Example:
* Solve this equation:

4x + 3y = 21

2x - y = 3

* We take the second equation for the y substitution

-y = 3 – 2x

y = 2x - 3

* The second equation is solved for y, so we can substitute the expression into the y in the first equation

4x + 3(2x-3) = 21

4x + 6x – 9 = 21

10x = 30

x = 3

* Input the value of x into the solved y equation

y = 2x – 3

y = 2(3) – 3

y = 6 – 3

y = 3

* So the solution of the equations is x = 3 and y = 3.
* We can also check if the numbers is correct by putting the value into one of the original equations

First equation:

4(3) + 3(3) = 21

12 + 9 = 21

21 = 21

Second equation:

2(3) – 3 = 3

6 – 3 = 3

3 = 3

* As we can see the solution checks out.
  1. Exercise:
* Problem 1:

X + 5y = 13

2x – y = 4

Find the value of:

4x + 2y = ?

* Problem 2:

2s + 3j = 32.000

3s + 2j = 33.000

Find the value of:

s + 2j = ?

1. **Determinant**
   1. Definition:

The determinant of a matrix is the scalar value computed for a given square matrix. Linear algebra deals with the determinant, it is computed using the elements of a square matrix. It can be considered as the scaling factor for the transformation of a matrix.

* 1. Usage:

One application of matrix and determinant is that it can be used to solve linear equations in two or three variables. Matrices and determinants are also used to check the consistency of any system, whether they are consistent or not.

* 1. How to solve:
     + First we times the number in a cross pattern like this

|  | A  C | B  D |  |
| --- | --- | --- | --- |

* Then we cross multiply the elements starting from the top left and then subtracting the result
* AD - BC = result
  1. Cofactor: (https://youtu.be/urMI5l13Y0s)
* First we take the first row or column from the matrix (preferably the first row)
* Note: Cofactor is actually

|  | +  -  + | -  +  - | +  -  + |  |
| --- | --- | --- | --- | --- |

* Then we match the - and + with the corresponding numbers in the first row
* Then we write the numbers from the first row (Starting from the first number)

|  | N1  N4  N7 | -N2    N5  N8 | N3  N6  N9 |  |
| --- | --- | --- | --- | --- |

* So it’s written like this

N1 \* ( ( N5 \* N9 ) - ( N6 \* N8 ) )

N2 \* ( ( N4 \* N9 ) - ( N6 \* N7 ) ) –

N3 \* ( ( N5 \* N9 ) - ( N6 \* N8 ) ) +

* Finally we’ll get the result.
  1. Example:
     + Solve this equation:

|  | **1**  **3**  **2** | **2**  **3**  **1** | **1**  **2**  **3** |  |
| --- | --- | --- | --- | --- |

* First we take the first row

|  | **1**  **3**  **2** | **2**  **3**  **1** | **1**  **2**  **3** |  |
| --- | --- | --- | --- | --- |

* Then we take the value from each of the sub matrix by taking the column that is not under the number that we use on top. (repeat this for all the number on the top row.

|  | **1**  **3**  **2** | **2**  **3**  **1** | **1**  **2**  **3** |  |
| --- | --- | --- | --- | --- |

|  | 3  1 | 2  3 |  |
| --- | --- | --- | --- |

1 ( 3 x 3 ) - ( 1 x 2 )

1 ( 9 - 2 )

1 x 7

7

|  | **1**  **3**  **2** | **- 2**  **3**  **1** | **1**  **2**  **3** |  |
| --- | --- | --- | --- | --- |

|  | 3  2 | 2  3 |  |
| --- | --- | --- | --- |

-2 ( 3 x 3 ) - ( 2 x 2 )

-2 ( 9 - 4 )

-2 x 5

-10

|  | **1**  **3**  **2** | **2**  **3**  **1** | **1**  **2**  **3** |  |
| --- | --- | --- | --- | --- |

|  | 3  2 | 3  1 |  |
| --- | --- | --- | --- |

1 ( 3 x 1 ) - ( 3 x 2 )

1 ( 3 + 6 )

1 x 9

9

* Finally we total all the result we get from the 2x2 matrix

7 - 10 + 9 = 6

* 1. Exercise:
* Problem 1:

|  | **1**  **2**  **-1** | **2**  **3**  **2** | **3**  **2**  **2** |  |
| --- | --- | --- | --- | --- |

* Problem 2:

|  | **2**  **3**  **1** | **1**  **2**  **3** | **4**  **0**  **6** |  |
| --- | --- | --- | --- | --- |