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## ALGEBRA

Algebra is one of the broad areas of mathematics. Roughly speaking, algebra is the study of mathematical symbols and the rules for manipulating these symbols in formulas.

# Father of Algebra



**Al Khawarizmi**

**Al-Khwarizmi is the father of mathematics and the founder of algebra. The scientist was one of the greats of the Middle Ages and a mathematician. Known as the father of algebra, he wrote books on mathematics using Indian numerals, including zero and the first decimal notation.**

**This of course has something to do with the four basic mathematical operations, namely addition, subtraction, multiplication, and division.**

**The meaning of Algebra itself is returning or moving from negative numbers to the side of the positive number equation. Al-Khwarizmi also provides the basic concept of quadratic equations for proving cases of geometric figures.**

# Usage Algebra



## Business and financial management

Your business owner or investor will use algebraic operations to calculate profits.



## Computer programming

Programmers are one of the professions that have the most interaction with algebra.



## Improve logical thinking

Algebraic operations will help you in making decisions which will affect your daily life.

## SPLDV (Sistem Persamaan Linear Dua Variabel)

zenius

$$2x + 4y = 18$$

Diagram illustrating the components of the linear equation  $2x + 4y = 18$ :

- koefisien** (coefficient) points to the number 2.
- variabel** (variable) points to the letter  $x$ .
- konstanta** (constant) points to the number 18.

## SPLTV (Sistem Persamaan Linear Tiga Variabel)

zenius

Konstanta

$$2x + 4y + 3z = 20$$

Koefisien

Variabel





## Substitution

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.



## Example

1. determine the value of x and y by means of substitution

$$4x + 3y = 21 \text{ ..... Equation (1)}$$

$$2x - y = 3 \text{ ..... Equation (2)}$$

**Answer:**

Take the equation that has the coefficients  
The smallest, in this case is equation 2

$$2x - y = 3$$

$$- y = 3 - 2x$$

$$y = 2x - 3 \text{ ..... Equation (3)}$$

Enter the Y value in  
**Equation 1**

$$4x + 3y = 21$$

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

$$4x + 6x - 9 = 21$$

$$10x = 21 + 9$$

$$10x = 30$$

$$x = 3$$

Enter the value of X  
You can insert in  
**equation 2**  
Or **equation 3**

$$y = 2x - 3$$

$$Y = 2(3) - 3$$

$$Y = 6 - 3$$

$$Y = 3$$

$$\text{HP} = \{3, 3\}$$



## Elimination

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.



## Example

1. determine the value of x and y by means of Elimination

$$4x + 3y = 21$$

$$2x - y = 3$$

**Answer:**

Eliminate X

$$4x + 3y = 21 \quad | \times 1 \rightarrow 4x + 3y = 21$$

$$2x - y = 3 \quad | \times 2 \rightarrow 4x - 2y = 6$$

$$4x + 3y = 21$$

$$\underline{4x - 2y = 6} \quad -$$

$$5y = 15$$

$$y = 3$$

Eliminate y

$$4x + 3y = 21 \quad | \times 1 \rightarrow 4x + 3y = 21$$

$$2x - y = 3 \quad | \times 3 \rightarrow 6x - 3y = 9$$

$$4x + 3y = 21$$

$$\underline{6x - 3y = 9} \quad +$$

$$10x = 30$$

$$x = 3$$

$$HP = \{3, 3\}$$



## Determinant

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.

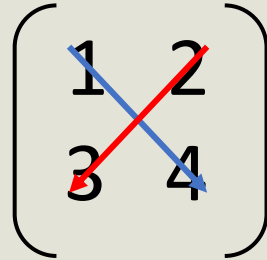


## Example Sarrus Method

$$\begin{pmatrix} 1 & 2 \\ 3 & 4 \end{pmatrix}$$

The determinant  
value of A is ?

**Answer:**

$$\begin{pmatrix} 1 & 2 \\ 3 & 4 \end{pmatrix}$$


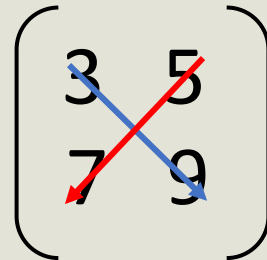
$$\text{Det}(A) = (1 \times 4) - (3 \times 2)$$

$$\text{Det}(A) = 4 - 6$$

$$\text{Det}(A) = -2$$

$$\begin{pmatrix} 3 & 5 \\ 7 & 9 \end{pmatrix}$$

The determinant  
value of A is ?

$$\begin{pmatrix} 3 & 5 \\ 7 & 9 \end{pmatrix}$$


$$\text{Det}(A) = (3 \times 9) - (5 \times 7)$$

$$\text{Det}(A) = 27 - 35$$

$$\text{Det}(A) = -8$$



## Example Sarrus Method

$$\begin{pmatrix} 1 & 2 & 1 \\ 3 & 3 & 2 \\ 2 & 1 & 3 \end{pmatrix}$$

The determinant  
value of A is ?

**Answer:**

$$\begin{pmatrix} 1 & 2 & 1 & 1 & 2 \\ 3 & 3 & 2 & 3 & 3 \\ 2 & 1 & 3 & 2 & 1 \end{pmatrix}$$

$$\text{Det (A)} = ((1 \times 3 \times 3) + (2 \times 2 \times 2) + (1 \times 3 \times 1)) - ((1 \times 3 \times 2) + (1 \times 2 \times 1) + (2 \times 3 \times 3))$$

$$\text{Det (A)} = (9 + 8 + 3) - (6 + 2 + 18)$$

$$\text{Det (A)} = 20 - 26$$

$$\text{Det (A)} = -6$$

## Example Cofactor Method

$$\begin{pmatrix} 1 & 2 & 1 \\ 3 & 3 & 2 \\ 2 & 1 & 3 \end{pmatrix}$$

The determinant value of A is ?

**Answer:**

$$\begin{pmatrix} 1 & 2 & 1 \\ 3 & 3 & 2 \\ 2 & 1 & 3 \end{pmatrix}$$

$$\begin{pmatrix} + & - & + \\ - & + & - \\ + & - & + \end{pmatrix}$$

$$\begin{pmatrix} \boxed{1} & \boxed{2} & \boxed{1} \\ 3 & 3 & 2 \\ 2 & 1 & 3 \end{pmatrix}$$

$$+1 \begin{pmatrix} 3 & 2 \\ 1 & 3 \end{pmatrix} \Rightarrow$$

$$\begin{aligned} &1((3 \times 3) - (1 \times 2)) \\ &1(9 - 2) \\ &1 \times 7 \\ &7 \end{aligned}$$

$$\begin{pmatrix} 1 & \boxed{2} & 1 \\ 3 & \boxed{3} & 2 \\ 2 & 1 & \boxed{3} \end{pmatrix}$$

$$-2 \begin{pmatrix} 3 & 2 \\ 2 & 3 \end{pmatrix} \Rightarrow$$

$$\begin{aligned} &-2((3 \times 3) - (2 \times 2)) \\ &-2(9 - 4) \\ &(-2) \times 5 \\ &-10 \end{aligned}$$

$$\begin{pmatrix} 1 & 2 & \boxed{1} \\ 3 & 3 & \boxed{2} \\ 2 & 1 & \boxed{3} \end{pmatrix}$$

$$+1 \begin{pmatrix} 3 & 3 \\ 2 & 1 \end{pmatrix} \Rightarrow$$

$$\begin{aligned} &1((3 \times 1) + (3 \times 2)) \\ &1(3 + 6) \\ &1 \times 9 \\ &9 \end{aligned}$$

$$\begin{aligned} \text{Det (A)} &= 7 - 10 + 9 \\ \text{Det (A)} &= 6 \end{aligned}$$

# Question

1.  $2m - 3n = 2$   
 $5m + 2n = 24$

Then the value of  
 **$m - n$**  is?

2.  $X + 5y = 13$   
 $2x - y = 4$

Set value  
 **$4x + 2y$**  ?

5. 
$$\begin{pmatrix} 1 & 2 & 3 \\ 2 & 3 & 2 \\ -1 & 2 & 2 \end{pmatrix}$$

3.  $4x + 3y = 2.500$   
 $2x + 7y = 2.900$

Then the value of  
**Is  $2x + 2y = 1300$ ?**

4.  $2s + 3j = 32.000$   
 $3s + 2j = 33.000$

Set value  
 **$s + 2h$**  ?

6. 
$$\begin{pmatrix} 2 & 1 & 4 \\ 3 & 2 & 0 \\ 1 & 3 & 6 \end{pmatrix}$$



## CONCLUSION

- **Substitution** -> Changing position
- **Elimination** -> Make it disappear
- **Determinant** -> Matrix