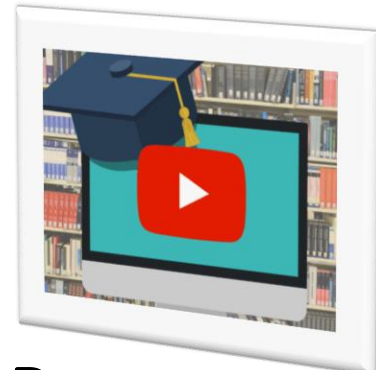
OGUN DIGICLASS

CLASS: SECONDARY SCHOOL

SUBJECT: MATHEMATICS

TOPIC: MATRICES



SUB-TOPIC: ADDITION, SUBTRACTION, SCALAR, MULTIPLICATION AND PRODUCT OF MATRICES

Learning Objectives

- Define and identify types of matrices
- Add and subtract matrices
- Multiply scalar matrices
- Find product of matrices

Introduction to Matrices

matrices are used in representing real world data like traits of people, populations, habits, household spending, gender distribution, weather forecast e.t.c

The tables below gives information about two families which shows the amount of Bread , Sugar, Tea and Milk used in one week.

S/N	Ajayi's Family	Koya's Family
Bread (loaves)	10	8
Sugar (kg)	3	4
Tea (Tin)	2	1
Milk (Tin)	6	7

Matrices

- An arrangement of information presented in columns and rows is called a matrix.
- Each of the numbers within a matrix are called elements.
- e.g. The number of male and female students in 2 tutor groups can be shown in a 2×2 matrix.

$$\begin{array}{lc} & \begin{array}{cc} \text{Male} & \text{Female} \end{array} \\ \begin{array}{l} \text{Tutor group A} \\ \text{Tutor group B} \end{array} & \begin{bmatrix} 8 & 7 \\ 6 & 9 \end{bmatrix} \end{array}$$

Types of Matrices

ROW MATRIX: A matrix with only one row is called a row matrix or a row vector e.g

$(4 \quad 3 \quad 2)$ is a 1x3 row

COLUMN MATRIX: A matrix with only one column is called a column matrix.

$$\begin{pmatrix} 8 \\ 6 \\ -3 \end{pmatrix}$$

is a

3x1 atrix

SQUARE MATRIX: A matrix in which the number of rows equal the number of columns is a square matrix

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

2x2 square matrix

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

3x3 square matrix

TRIANGULAR MATRIX: If elements of a matrix above or below the principal diagonals are all zero, the matrix is said to be a triangular matrix.

$$\begin{pmatrix} 6 & 0 & 0 \\ 0 & 3 & 0 \\ 0 & 0 & -4 \end{pmatrix}$$

NULL MATRIX: A matrix which every element is zero is called a null matrix ort zero matrix. It is denoted by the symbol 0.

$$\begin{pmatrix} 0 & 0 \\ 0 & 0 \end{pmatrix}$$

2x2 zero matrix

$$\begin{pmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix}$$

2x3 zero matrix

A 2×3 Matrix

$$\text{2 rows}\;\left\{\underbrace{\begin{bmatrix}5 & 13 & -6\\ 4 & 2 & 7\end{bmatrix}}_{\text{3 columns}}\right.$$

A 3 × 2 Matrix

$$\text{3 rows}\;\left\{\begin{bmatrix} 9 & 0 \\ -4 & 5 \\ 8 & -6 \end{bmatrix}\right.$$

$$\underbrace{\begin{bmatrix} 9 & 0 \\ -4 & 5 \\ 8 & -6 \end{bmatrix}}_{\text{2 columns}}$$

Adding Matrices

- We can add matrices together as long as they contain the same number of rows and columns.

e.g.

$$\begin{bmatrix} 5 & 3 \\ -11 & 4 \end{bmatrix} + \begin{bmatrix} -2 & 6 \\ -6 & 0 \end{bmatrix} = \begin{bmatrix} 5+(-2) & 3+6 \\ (-11)+(-6) & 4+0 \end{bmatrix}$$

$$= \begin{bmatrix} 3 & 9 \\ -17 & 4 \end{bmatrix}$$

Addition of Matrices

If A and B are two matrices of the
same order, then their sum A + B is a matrix is:

Example:

If $A = \begin{pmatrix} 1 & 3 & 4 \\ 2 & 3 & 4 \\ -3 & 4 & -5 \end{pmatrix}$ and $B = \begin{pmatrix} 2 & 3 & 1 \\ 5 & 4 & 2 \\ 1 & -4 & 3 \end{pmatrix}$, then

$$A + B = \begin{pmatrix} 1 & 3 & 4 \\ 2 & 3 & 4 \\ -3 & 4 & -5 \end{pmatrix} + \begin{pmatrix} 2 & 3 & 1 \\ 5 & 4 & 2 \\ 1 & -4 & 3 \end{pmatrix} = \begin{pmatrix} 3 & 6 & 5 \\ 7 & 7 & 6 \\ -2 & 0 & -2 \end{pmatrix}$$

Subtraction of Matrices

If $A = \begin{pmatrix} 1 & 2 \\ 3 & 0 \end{pmatrix}$ and $B = \begin{pmatrix} 2 & -1 \\ 4 & 5 \end{pmatrix}$

Find A–B

Solution

$$A\text{-}B = \begin{pmatrix} 1-2 & 2-(-1) \\ 3-4 & 0-5 \end{pmatrix} = \begin{pmatrix} -1 & 3 \\ -1 & -5 \end{pmatrix}$$

Multiplication of a Matrix by a Scalar

We can multiply a matrix by a constant (k) by multiplying all elements by the constant.

Example:

$$\text{If } A = \begin{pmatrix} 1 & 3 & 4 \\ 1 & 2 & 3 \\ -1 & 1 & 1 \end{pmatrix}, \text{ then}$$

$$2A = 2\begin{pmatrix} 1 & 3 & 4 \\ 1 & 2 & 3 \\ -1 & 1 & 1 \end{pmatrix} = \begin{pmatrix} 2 & 6 & 8 \\ 2 & 4 & 6 \\ -2 & 2 & 2 \end{pmatrix}$$

If 2 matrices are equal, the elements can be equated

e.g. Find the values of a and b

$$\begin{pmatrix} 3 & a \\ -2 & 1 \end{pmatrix} \times \begin{pmatrix} 2 & -2 \\ -3 & b \end{pmatrix} = \begin{pmatrix} 12 & 2 \\ -7 & 0 \end{pmatrix}$$

Multiply out the left hand side

$$\begin{pmatrix} 3 & a \\ -2 & 1 \end{pmatrix} \times \begin{pmatrix} 2 & -2 \\ -3 & b \end{pmatrix} = \begin{pmatrix} 6-3a & -6+ab \\ -7 & 4+b \end{pmatrix}$$

Make equal to right hand side

$$\begin{pmatrix} 6-3a & -6+ab \\ -7 & 4+b \end{pmatrix} = \begin{pmatrix} 12 & 2 \\ -7 & 0 \end{pmatrix}$$

Equate elements in row 1, column 1

$$\begin{pmatrix} 6-3a & -6+ab \\ -7 & 4+b \end{pmatrix} = \begin{pmatrix} 12 & 2 \\ -7 & 0 \end{pmatrix}$$

$$6-3a=12$$
$$6-12=3a$$
$$-6=3a$$
$$\mathrm{a}=-2$$

Equate elements in row 2, column 2

$$\begin{pmatrix} 6-3a & -6+ab \\ -7 & 4+b \end{pmatrix} = \begin{pmatrix} 12 & 2 \\ -7 & 0 \end{pmatrix}$$

$$4+b=0$$
$$\mathrm{b}=-4$$

(Don't forget to check your answer)

$$\begin{pmatrix} \sqrt{2} & 1 \\ -1 & 3\sqrt{2} \end{pmatrix} \begin{pmatrix} \sqrt{2} & 0 \\ -3 & -2\sqrt{2} \end{pmatrix}$$

WAEC Past Question

Find x and y if

$$5\begin{pmatrix} 1 & 2 \\ 0 & -1 \end{pmatrix} - \begin{pmatrix} w & x \\ y & z \end{pmatrix} = 3\begin{pmatrix} 3 & 4 \\ -1 & 7 \end{pmatrix}$$

Assignment

- Find the matrix M that satisfy

$$\begin{pmatrix} 9 & 1 \\ 2 & 6 \end{pmatrix} + M = \begin{pmatrix} 3 & 7 \\ 6 & 8 \end{pmatrix} - M$$