Linear Algebra:

Matrix Representation of Linear Transformation

Let $U(F)$ and $V(F)$ are two vector spaces over F.

$T: U \to V$ be a linear Transformation.

Let $B = \{u_1, u_2, u_3, \ldots, u_n\}$ and $B' = \{v_1, v_2, v_3, \ldots, v_n\}$ are two <u>ordered basis</u> for U and V respectivley.

Now if any $\alpha \in U \Rightarrow T(\alpha) \in V$, also $T(\alpha)$ can be represent by B'

$$T(u_1) = \beta_1 = a_{11}v_1 + a_{12}v_2 + a_{13}v_3 + \cdots + a_{1m}v_m$$
$$T(u_2) = \beta_2 = a_{21}v_1 + a_{22}v_2 + a_{23}v_3 + \cdots + a_{2m}v_m$$
$$T(u_3) = \beta_3 = a_{31}v_1 + a_{32}v_2 + a_{33}v_3 + \cdots + a_{3m}v_m$$
$$\vdots \qquad \vdots \qquad \vdots \qquad \vdots \qquad \vdots$$
$$T(u_n) = \beta_n = a_{n1}v_1 + a_{n2}v_2 + a_{n3}v_3 + \cdots + a_{nm}v_m$$

$$\begin{bmatrix} T(u_1) \\ T(u_2) \\ \vdots \\ T(u_n) \end{bmatrix} = \underbrace{\begin{bmatrix} a_{11} & a_{12} & \cdots & a_{1m} \\ a_{21} & a_{22} & \cdots & a_{2m} \\ \vdots & \vdots & & \vdots \\ a_{n1} & a_{n2} & \cdots & a_{nm} \end{bmatrix}}_{\text{(Cofficient Matrix)}} \begin{bmatrix} v_1 \\ v_2 \\ \vdots \\ v_{nm} \end{bmatrix}$$