Define $T: R^3 \to R^3$ by $T(x, y, z) = (y + z, x + z, x - y)$

Assume that T is a linear Transformation

Write down the matrix representation A of T with respect to standard basis in domain and co domain.

Solution:

let,

Standard basis

$e_1 = (1, 0, 0), e_2 = (0, 1, 0), e_3 = (0, 0, 1)$

$$T(x, y, z) = (y + z, x + z, x - y)$$

$T(e_1) = (1, 0, 0) = (0, 1, 1) = 0(1,0,0) + 1(0,1,0) + 1(0,0,1)$

$T(e_2) = (0, 1, 0) = (1, 0, -1) = 1(1,0,0) + 0(0,1,0) + (-1)(0,0,1)$

$T(e_3) = (0, 0, 1) = (1, 1, 0) = 1(1,0,0) + 1(0,1,0) + 0(0,0,1)$

The matrix Representation of T is

$$A = \begin{bmatrix} 0 & 1 & 1 \\ 1 & 0 & 1 \\ 1 & -1 & 0 \end{bmatrix}$$

Linear $R^3 \to R^3$