Assignment 3

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1 PROBLEM

Solve the equation

$$\begin{vmatrix} x + a & x & x \\ x & x + a & x \\ x & x & x + a \end{vmatrix} = 0 \ , \ a \neq 0.$$

2 EXPLANATION

Given,

$$\begin{vmatrix} x + a & x & x \\ x & x + a & x \\ x & x & x + a \end{vmatrix} \xleftarrow{R_1 \leftarrow R_1 + R_2 + R_3} \quad (2.0.1)$$

$$\begin{vmatrix} 3x + a & 3x + a & 3x + a \\ x & x + a & x \\ x & x & x + a \end{vmatrix} \quad (2.0.2)$$

$$(3x + a) \begin{vmatrix} 1 & 1 & 1 \\ x & x + a & x \\ x & x & x + a \end{vmatrix} \xleftarrow{C_2 \leftarrow C_2 - C_1} \quad (2.0.3)$$

$$(3x + a) \begin{vmatrix} 1 & 0 & 1 \\ x & a & x \\ x & 0 & x + a \end{vmatrix} \xleftarrow{C_3 \leftarrow C_3 - C_1} \quad (2.0.4)$$

$$(3x + a) \begin{vmatrix} 1 & 0 & 0 \\ x & a & 0 \\ x & 0 & a \end{vmatrix} = (3x + a)(a^2) \quad (2.0.5)$$

$$(2.0.6)$$

Since a cannot be equal to zero, 3x+a should be zero for determinant to be zero

$$3x + a = 0 \quad (2.0.7)$$

$$\implies a = -3x \quad (2.0.8)$$