

Assignment 2

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Determinant

Abstract—This document contains the solution to find the value of given Determinant.

Download all python codes from

<https://github.com/rubeenaafreen20/EE5609/tree/master/Assignment2/codes>

Download latex-tikz codes from

<https://github.com/rubeenaafreen20/EE5609/tree/master/Assignment2>

1 PROBLEM

Prove the following:

$$\begin{vmatrix} 3a & -a+b & -a+c \\ -b+a & 3b & -b+c \\ -c+a & -c+b & 3c \end{vmatrix} = 3(a+b+c)(ab+bc+ca)$$

2 SOLUTION

Applying transformation:

$$\begin{vmatrix} 3a & -a+b & -a+c \\ -b+a & 3b & -b+c \\ -c+a & -c+b & 3c \end{vmatrix} \quad (2.0.1)$$

$$\xleftrightarrow{C_1 \leftarrow C_1 + C_2 + C_3} \begin{vmatrix} a+b+c & -a+b & -a+c \\ a+b+c & 3b & -b+c \\ a+b+c & -c+b & 3c \end{vmatrix} \quad (2.0.2)$$

$$\xleftrightarrow{\begin{matrix} R_3 \leftarrow R_3 - R_2 \\ R_2 \leftarrow R_2 - R_1 \end{matrix}} (a+b+c) \begin{vmatrix} 1 & -a+b & -a+c \\ 0 & a+2b & a-b \\ 0 & -2b-c & b+2c \end{vmatrix} \quad (2.0.3)$$

$$\begin{aligned} &= (a+b+c)\{(a+2b)(b+2c) + (2b+c)(a-b)\} \\ &= (a+b+c)\{ab+2ac+2b^2+4bc+2ab-2b^2+ca-cb\} \\ &= (a+b+c)(3ab+3bc+3ca) \\ &= 3(a+b+c)(ab+bc+ca) \end{aligned} \quad (2.0.4)$$