Matrix theory - Assignment3

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Abstract—This document illustrates finding determinant of matrix using properties of determinant

Download all python codes from

https://github.com/shreeprasadbhat/matrix−theory/tree/master/assignment3/codes

and latex-tikz codes from

https://github.com/shreeprasadbhat/matrix−theory/blob/master/assignment3/

1 PROBLEM

Show that

$$\begin{vmatrix} -a^2 & ab & ac \\ ba & -b^2 & bc \\ ca & cb & -c^2 \end{vmatrix} = 4a^2b^2c^2 \qquad (1.0.1)$$

2 SOLUTION

$$\begin{vmatrix} -a^2 & ab & ac \\ ba & -b^2 & bc \\ ca & cb & -c^2 \end{vmatrix} = abc \begin{vmatrix} -a & b & c \\ a & -b & c \\ a & b & -c \end{vmatrix} \qquad (2.0.1)$$

$$= abc \begin{vmatrix} -a & a & a \\ b & -b & b \\ c & c & -c \end{vmatrix} \qquad (2.0.2)$$

$$= a^2b^2c^2 \begin{vmatrix} -1 & 1 & 1 \\ 1 & -1 & 1 \\ 1 & 1 & -1 \end{vmatrix} \qquad (2.0.3)$$

$$= a^2b^2c^2 \begin{vmatrix} 1 & -1 & 1 \\ 1 & 1 & -1 \\ -1 & 1 & 1 \end{vmatrix} \qquad (2.0.4)$$

$$\xrightarrow[R_3 \leftarrow R_3 - R_1]{R_2 \leftarrow R_2 - R_1} a^2b^2c^2 \begin{vmatrix} 1 & -1 & 1 \\ 0 & 2 & -2 \\ 0 & 0 & 2 \end{vmatrix} \qquad (2.0.5)$$

$$= a^2b^2c^2 \times (1 \times 2 \times 2) \qquad (2.0.6)$$

$$= 4a^2b^2c^2 \qquad (2.0.7)$$