Answer on Question #78476 – Math – Linear Algebra

Question

Give examples, with justification, of the following:

two non-zero, 3×3 matrices A and B, with $|A| = 0$, $|B| = (5/7)i$

Solution

If matrix has determinant equal to zero, it can be written in a form with one or more rows or columns filled with zeroes. Let choose A to be

$$A = \begin{pmatrix} 1 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix}$$

To satisfy condition $|B| = (5/7)i$ we can choose matrix B to be diagonal with all non-zero elements equal to 1, except for one, which must be $(5/7)i$, in order to satisfy the given condition. For example:

$$B = \begin{pmatrix} (5/7)i & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{pmatrix}$$

Indeed,

$$|B| = \begin{vmatrix} (5/7)i & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{vmatrix} = (5/7)i \cdot 1 \cdot 1 = (5/7)i$$

Answer: $A = \begin{pmatrix} 1 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix}$, $B = \begin{pmatrix} (5/7)i & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{pmatrix}$.