Determinants and Inverses of 3x3 matrices IB SL/HL

For these questions the matrices have been defined as:

$$A=\begin{bmatrix}1 & 3 & 2\\ -1 & 2 & -1\\ 2 & -2 & 3\end{bmatrix}, B=\begin{bmatrix}2 & -3 & 2\\ 1 & 0 & -1\\ 4 & 5 & 3\end{bmatrix}, C=\begin{bmatrix}-2 & -3 & 5\\ 1 & p & 1\\ -2 & 1 & -1\end{bmatrix}, D=\begin{bmatrix}1 & 0 & 0\\ 0 & 1 & 0\\ 0 & 0 & 1\end{bmatrix}, E=\begin{bmatrix}2\\ 3\\ -1\end{bmatrix}$$

1. Show that the determinant of matrix A = 3.

2. Find the value of p such that C is a singular, non-zero matrix.

3. State which matrix you obtain when the BB^{-1}.

4. Solve the following,

   a) AB
   b) BA
   c) B^2
   d) AE
   e) EB

5. Solve the equations,

   a)
   $$\begin{aligned} x + 3y + 2z &= 15\\ -x + 2y - z &= 0\\ 2x - 2y + 3z &= 9 \end{aligned}$$

   b)
   $$\begin{aligned} 2x - 3y + 2z &= -8\\ x - z &= 4\\ 4x + 5y + 3z &= 29 \end{aligned}$$

6. Explain why you can not solve,

   $$\begin{aligned} -2x - 3y + 5 &= 2\\ x + py - z &= 3\\ -2x + y - z &= 4 \end{aligned}$$

   using matrices.

   Assume you are using the value of p, found in question 2.

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Solutions

2. $p = -\frac{5}{6}$.

3. $D = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$

4. a) $\begin{bmatrix} 13 & 7 & 5 \\ -4 & -2 & -7 \\ 14 & 9 & 15 \end{bmatrix}$

   b) $\begin{bmatrix} 9 & -4 & 13 \\ -1 & 5 & -1 \\ 5 & 16 & 12 \end{bmatrix}$

   c) $\begin{bmatrix} 9 & 4 & 13 \\ -2 & -8 & -1 \\ 25 & 3 & 12 \end{bmatrix}$

   d) $\begin{bmatrix} 9 \\ 5 \\ -5 \end{bmatrix}$

   e) Not possible

5. a) $x = -1, y = 2, z = 5$

   b) $x = 3, y = 4, z = -1$

6. Because matrix C has no inverse, as the determinant is 0.