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Quiz 6

This quiz is graded out of 10 marks. No books, calculators, notes or cell phones are allowed. You must show all your work, the correct answer is worth 1 mark the remaining marks are given for the work. If you need more space for your answer use the back of the page.

Question 1. §2.3 #20 *(5 marks)* Decide whether the given matrix is invertible, and if so, use the adjoint method to find its inverse.

$$A = \begin{bmatrix} 2 & 0 & 3 \\ 0 & 3 & 2 \\ -2 & 0 & -4 \end{bmatrix}$$

$C_{11} = (-1)^{1+1}\begin{vmatrix} 3 & 2 \\ 0 & -4 \end{vmatrix} = -12$, $C_{12} = (-1)^{1+2}\begin{vmatrix} 0 & 2 \\ -2 & -4 \end{vmatrix} = -4$

$C_{13} = (-1)^{1+3}\begin{vmatrix} 0 & 3 \\ -2 & 0 \end{vmatrix} = 6$, $C_{21} = (-1)^{2+1}\begin{vmatrix} 0 & 3 \\ 0 & -4 \end{vmatrix} = 0$

$C_{22} = (-1)^{2+2}\begin{vmatrix} 2 & 3 \\ -2 & -4 \end{vmatrix} = -2$, $C_{23} = (-1)^{2+3}\begin{vmatrix} 2 & 0 \\ -2 & 0 \end{vmatrix} =$, $C_{31} = (-1)^{3+1}\begin{vmatrix} 0 & 3 \\ 3 & 2 \end{vmatrix} = -9$

$C_{32} = (-1)^{3+2}\begin{vmatrix} 2 & 3 \\ 0 & 2 \end{vmatrix} = -4$, $C_{33} = (-1)^{3+3}\begin{vmatrix} 2 & 0 \\ 0 & 3 \end{vmatrix} = 6$

$|A| = 3(-1)^{2+2}\begin{vmatrix} 2 & 3 \\ -2 & -4 \end{vmatrix} = -6$

$$\therefore A^{-1} = \frac{1}{\det A}\operatorname{adj} A = \frac{1}{-6}\begin{bmatrix} -12 & -4 & 6 \\ 0 & -2 & 0 \\ -9 & -4 & 6 \end{bmatrix}^T = \frac{-1}{6}\begin{bmatrix} -12 & 0 & -9 \\ -4 & -2 & -4 \\ 6 & 0 & 6 \end{bmatrix}$$

Question 2. §3.1 #31 *(5 marks)* Show that there do not exist scalars c_1, c_2 and c_3 such that

$c_1(-2,9,6)+c_2(-3,2,1)+c_3(1,7,5)=(0,5,4)$

$$\begin{aligned} -2c_1 - 3c_2 + c_3 &= 0 \\ 9c_1 + 2c_2 + 7c_3 &= 5 \\ 6c_1 + c_2 + 5c_3 &= 4 \end{aligned}$$

$$\begin{bmatrix} -2 & -3 & 1 & 0 \\ 9 & 2 & 7 & 5 \\ 6 & 1 & 5 & 4 \end{bmatrix} \sim_{2R_2 \to R_2} \begin{bmatrix} -2 & -3 & 1 & 0 \\ 18 & 4 & 14 & 10 \\ 6 & 1 & 5 & 4 \end{bmatrix}$$

$$\sim_{\substack{9R_1+R_2\to R_2 \\ 3R_1+R_3\to R_3}} \begin{bmatrix} -2 & -3 & 1 & 0 \\ 0 & -23 & 23 & 10 \\ 0 & -8 & 8 & 4 \end{bmatrix}$$

$$\sim_{-\frac{8}{23}R_2+R_3\to R_3} \begin{bmatrix} -2 & -3 & 1 & 0 \\ 0 & -23 & 23 & 10 \\ 0 & 0 & 0 & 4-\frac{80}{23} \end{bmatrix}$$

$0c_1 + 0c_2 + 0c_3 = 4 - \frac{80}{23}$

no (c_1, c_2, c_3) satisfy the above.