

## Week 07 Participation Assignment (3 of 3)

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## 1 Part 3

Consider the matrix

$$\begin{bmatrix} 1 & -3 & 2 \\ 5 & 4 & -1 \\ -3 & 2 & -4 \end{bmatrix}$$

. Find the inverse of  $A$  using the method indicated:

- 1) Use elementary row operations on  $[A|I]$  to convert it into  $[I|A^{-1}]$ .
- 2) Use the adjoint matrix.

### 1.1 1)

$$[I|A^{-1}] = \left[ \begin{array}{ccc|ccc} 1 & -3 & 2 & 1 & 0 & 0 \\ 5 & 4 & -1 & 0 & 1 & 0 \\ -3 & 2 & -4 & 0 & 0 & 1 \end{array} \right]$$

$$A_2 = A_2 - 5A_1$$

$$A_3 = A_3 + 3A_1$$

$$[I|A^{-1}] = \left[ \begin{array}{ccc|ccc} 1 & -3 & 2 & 1 & 0 & 0 \\ 0 & 19 & -11 & -5 & 1 & 0 \\ 0 & -7 & 2 & 3 & 0 & 1 \end{array} \right]$$

$$A_3 = A_3 + \frac{7}{19}A_2$$

$$[I|A^{-1}] = \left[ \begin{array}{ccc|ccc} 1 & -3 & 2 & 1 & 0 & 0 \\ 0 & 19 & -11 & -5 & 1 & 0 \\ 0 & 0 & -\frac{39}{19} & \frac{22}{19} & \frac{7}{19} & 1 \end{array} \right]$$

$$A_1 = A_1 + \frac{3}{19}A_2$$

$$[I|A^{-1}] = \left[ \begin{array}{ccc|ccc} 1 & 0 & \frac{5}{19} & \frac{4}{19} & \frac{3}{19} & 0 \\ 0 & 19 & -11 & -5 & 1 & 0 \\ 0 & 0 & -\frac{39}{19} & \frac{22}{19} & \frac{7}{19} & 1 \end{array} \right]$$

$$A_1 = A_1 + \frac{5}{39}A_3$$

$$[I|A^{-1}] = \left[ \begin{array}{ccc|ccc} 1 & 0 & 0 & \frac{14}{39} & \frac{8}{39} & \frac{5}{39} \\ 0 & 19 & -11 & -5 & 1 & 0 \\ 0 & 0 & -\frac{39}{19} & \frac{22}{19} & \frac{7}{19} & 1 \end{array} \right]$$

$$A_2 = \frac{1}{19}A_2$$

$$[I|A^{-1}] = \left[ \begin{array}{ccc|ccc} 1 & 0 & 0 & \frac{14}{39} & \frac{8}{39} & \frac{5}{39} \\ 0 & 1 & -\frac{11}{19} & -\frac{5}{19} & \frac{1}{19} & 0 \\ 0 & 0 & -\frac{39}{19} & \frac{22}{19} & \frac{7}{19} & 1 \end{array} \right]$$

$$A_2 = A_2 - \frac{11}{39}A_3$$

$$[I|A^{-1}] = \left[ \begin{array}{ccc|ccc} 1 & 0 & 0 & \frac{14}{39} & \frac{8}{39} & \frac{5}{39} \\ 0 & 1 & 0 & -\frac{23}{39} & -\frac{2}{39} & -\frac{11}{39} \\ 0 & 0 & -\frac{39}{19} & \frac{22}{19} & \frac{7}{19} & 1 \end{array} \right]$$

$$A_3 = -\frac{19}{39}A_3$$

$$[I|A^{-1}] = \left[ \begin{array}{ccc|ccc} 1 & 0 & 0 & \frac{14}{39} & \frac{8}{39} & \frac{5}{39} \\ 0 & 1 & 0 & -\frac{23}{39} & -\frac{2}{39} & -\frac{11}{39} \\ 0 & 0 & 1 & -\frac{22}{39} & -\frac{7}{39} & -\frac{19}{39} \end{array} \right]$$

$$\boxed{[I|A^{-1}] = \left[ \begin{array}{ccc|ccc} 1 & 0 & 0 & \frac{14}{39} & \frac{8}{39} & \frac{5}{39} \\ 0 & 1 & 0 & -\frac{23}{39} & -\frac{2}{39} & -\frac{11}{39} \\ 0 & 0 & 1 & -\frac{22}{39} & -\frac{7}{39} & -\frac{19}{39} \end{array} \right]}$$

## 1.2 2)

$$\det(A) = (1)(4 \cdot -4 - -1 \cdot 2) - (-3)(5 \cdot -4 - -1 \cdot -3) + (2)(5 \cdot 2 - 4 \cdot -3)$$

$$\det(A) = -39$$

$$C = \begin{bmatrix} \det \begin{bmatrix} 4 & -1 \\ 2 & -4 \end{bmatrix} & \det \begin{bmatrix} 5 & -1 \\ -3 & -4 \end{bmatrix} & \det \begin{bmatrix} 5 & 4 \\ -3 & 2 \end{bmatrix} \\ \det \begin{bmatrix} -3 & 2 \\ 2 & -4 \end{bmatrix} & \det \begin{bmatrix} 1 & 2 \\ -3 & -4 \end{bmatrix} & \det \begin{bmatrix} 1 & -3 \\ -3 & 2 \end{bmatrix} \\ \det \begin{bmatrix} -3 & 2 \\ 4 & -1 \end{bmatrix} & \det \begin{bmatrix} 1 & 2 \\ 5 & -1 \end{bmatrix} & \det \begin{bmatrix} 1 & -3 \\ 5 & 4 \end{bmatrix} \end{bmatrix}$$

$$C = \begin{bmatrix} -14 & -23 & 22 \\ 8 & 2 & 7 \\ -5 & -11 & 19 \end{bmatrix}$$

$$\text{Adj} = \begin{bmatrix} -14 & -8 & -5 \\ 23 & 2 & 11 \\ 22 & 7 & 19 \end{bmatrix}$$

$$A^{-1} = \frac{1}{-39} \begin{bmatrix} -14 & -8 & -5 \\ 23 & 2 & 11 \\ 22 & 7 & 19 \end{bmatrix}$$

$$A^{-1} = \begin{bmatrix} \frac{14}{39} & \frac{8}{39} & \frac{5}{39} \\ -\frac{23}{39} & -\frac{2}{39} & -\frac{11}{39} \\ -\frac{22}{39} & -\frac{7}{39} & -\frac{19}{39} \end{bmatrix}$$

$$A^{-1} = \begin{bmatrix} \frac{14}{39} & \frac{8}{39} & \frac{5}{39} \\ -\frac{23}{39} & -\frac{2}{39} & -\frac{11}{39} \\ -\frac{22}{39} & -\frac{7}{39} & -\frac{19}{39} \end{bmatrix}$$