

Exercise 1.5

Q1. Find the determinant of the following matrices.

$$(i) \quad A = \begin{bmatrix} -1 & 1 \\ 2 & 0 \end{bmatrix}$$

$$(ii) \quad B = \begin{bmatrix} 1 & 3 \\ 2 & -2 \end{bmatrix}$$

$$(iii) \quad C = \begin{bmatrix} 3 & 2 \\ 3 & 2 \end{bmatrix}$$

$$(iv) \quad D = \begin{bmatrix} 3 & 2 \\ 1 & 4 \end{bmatrix}$$

Solution:

$$(i) \quad A = \begin{bmatrix} -1 & 1 \\ 2 & 0 \end{bmatrix}$$

Determinant of matrix A is calculated as:

$$|A| = \det A = \begin{vmatrix} -1 & 1 \\ 2 & 0 \end{vmatrix} = (-1) \times 0 - 2 \times 1$$

$$|A| = 0 - 2 = -2$$

$$(ii) \quad B = \begin{bmatrix} 1 & 3 \\ 2 & -2 \end{bmatrix}$$

Determinant of matrix B is calculated as:

$$|B| = \det B = \begin{vmatrix} 1 & 3 \\ 2 & -2 \end{vmatrix} = 1 \times (-2) - 2 \times 3$$

$$|B| = -2 - 6 = -8$$

$$(iii) \quad C = \begin{bmatrix} 3 & 2 \\ 3 & 2 \end{bmatrix}$$

Determinant of matrix C is calculated as:

$$|C| = \det C = \begin{vmatrix} 3 & 2 \\ 3 & 2 \end{vmatrix} = 3 \times 2 - 2 \times 3$$

$$|C| = 6 - 6 = 0$$

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(iv) $D = \begin{bmatrix} 3 & 2 \\ 1 & 4 \end{bmatrix}$

Determinant of matrix D is calculated as:

$$|D| = \det D = \begin{vmatrix} 3 & 2 \\ 1 & 4 \end{vmatrix} = 3 \times 4 - 2 \times 1$$

$$|D| = 12 - 2 = 10$$

Q2. Find which of the following matrices are singular or non-singular?

(i) $A = \begin{bmatrix} 3 & 6 \\ 2 & 4 \end{bmatrix}$

(ii) $B = \begin{bmatrix} 4 & 1 \\ 3 & 2 \end{bmatrix}$

(iii) $C = \begin{bmatrix} 7 & -9 \\ 3 & 5 \end{bmatrix}$

(iv) $D = \begin{bmatrix} 5 & -10 \\ -2 & 4 \end{bmatrix}$

Solution:

A matrix is said to be singular if its determinant is equal to zero, i.e. $|A| = 0$

(i) $A = \begin{bmatrix} 3 & 6 \\ 2 & 4 \end{bmatrix}$

Determinant of matrix A is calculated as:

$$|A| = \det A = \begin{vmatrix} 3 & 6 \\ 2 & 4 \end{vmatrix} = 3 \times 4 - 2 \times 6$$

$$|A| = 12 - 12 = 0$$

As, determinant of A is equal to zero so, A is a singular matrix.

(ii) $B = \begin{bmatrix} 4 & 1 \\ 3 & 2 \end{bmatrix}$

Determinant of matrix B is calculated as:

$$|B| = \det B = \begin{vmatrix} 4 & 1 \\ 3 & 2 \end{vmatrix} = 4 \times 2 - 1 \times 3$$

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$$|B| = 8 - 3 = 5 \neq 0$$

As, determinant of B is not equal to zero so, B is not a singular matrix.

$$(iii) \quad C = \begin{bmatrix} 7 & -9 \\ 3 & 5 \end{bmatrix}$$

Determinant of matrix C is calculated as:

$$|C| = \det C = \begin{vmatrix} 7 & -9 \\ 3 & 5 \end{vmatrix} = 7 \times 5 - 3 \times (-9)$$

$$|C| = 35 + 27 = 62 \neq 0$$

As, determinant of C is not equal to zero so, C is not a singular matrix.

$$(iv) \quad D = \begin{bmatrix} 5 & -10 \\ -2 & 4 \end{bmatrix}$$

Determinant of matrix D is calculated as:

$$|D| = \det D = \begin{vmatrix} 5 & -10 \\ -2 & 4 \end{vmatrix} = 5 \times 4 - (-10) \times (-2)$$

$$|D| = 20 - 20 = 0$$

As, determinant of D is equal to zero so, D is a singular matrix.

Q3. Find the multiplicative inverse (if it exists) of each.

$$(i) \quad A = \begin{bmatrix} -1 & 3 \\ 2 & 0 \end{bmatrix}$$

$$(ii) \quad B = \begin{bmatrix} 1 & 2 \\ -3 & -5 \end{bmatrix}$$

$$(iii) \quad C = \begin{bmatrix} -2 & 6 \\ 3 & -9 \end{bmatrix}$$

$$(iv) \quad D = \begin{bmatrix} 1/2 & 3/4 \\ 1 & 2 \end{bmatrix}$$

Solution:

$$(i) \quad A = \begin{bmatrix} -1 & 3 \\ 2 & 0 \end{bmatrix}$$

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The multiplicative inverse of matrix A is calculated as:

$$A^{-1} = \frac{\text{Adj } A}{|A|}$$

$$\text{Adj } A = \begin{bmatrix} 0 & -3 \\ -2 & -1 \end{bmatrix}$$

$$|A| = \begin{bmatrix} -1 & 3 \\ 2 & 0 \end{bmatrix}$$

$$|A| = (-1) \times 0 - 2 \times (3) = 0 - 6 \neq 0$$

Since it is a non-singular matrix therefore solution is possible

$$A^{-1} = \frac{\begin{bmatrix} 0 & -3 \\ -2 & -1 \end{bmatrix}}{-6}$$

$$= \begin{bmatrix} \frac{0}{-6} & \frac{-3}{-6} \\ \frac{-2}{-6} & \frac{-1}{-6} \end{bmatrix}$$

$$= \begin{bmatrix} 0 & \frac{1}{2} \\ \frac{1}{3} & \frac{1}{6} \end{bmatrix}$$

$$A^{-1} = \begin{bmatrix} 0 & \frac{1}{2} \\ \frac{1}{3} & \frac{1}{6} \end{bmatrix}$$

(ii) $B = \begin{bmatrix} 1 & 2 \\ -3 & -5 \end{bmatrix}$

The multiplicative inverse of matrix B is calculated as:

$$B^{-1} = \frac{\text{Adj } B}{|B|}$$

$$\text{Adj } B = \begin{bmatrix} -5 & -2 \\ 3 & 1 \end{bmatrix}$$

$$|B| = \begin{bmatrix} 1 & 2 \\ -3 & -5 \end{bmatrix}$$

$$|B| = 1 \times (-5) - (-3) \times (2) = -5 + 6 = 1 \neq 0$$

Since it is a non-singular matrix therefore solution is possible

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$$\begin{aligned} B^{-1} &= \frac{\begin{bmatrix} -5 & -2 \\ 3 & 1 \end{bmatrix}}{1} \\ &= \begin{bmatrix} -5 & -2 \\ 3 & 1 \end{bmatrix} \\ B^{-1} &= \begin{bmatrix} -5 & -2 \\ 3 & 1 \end{bmatrix} \end{aligned}$$

(iii) $C = \begin{bmatrix} -2 & 6 \\ 3 & -9 \end{bmatrix}$

The multiplicative inverse of matrix C is calculated as:

$$C^{-1} = \frac{\text{Adj } C}{|C|}$$

$$\text{Adj } C = \begin{bmatrix} -5 & -2 \\ 3 & 1 \end{bmatrix}$$

$$|C| = \begin{bmatrix} -9 & -6 \\ -3 & -2 \end{bmatrix}$$

$$|C| = (-9) \times (-2) - (-3) \times (-6) = 18 - 18 = 0$$

Since it is a singular matrix therefore solution is not possible

$$C^{-1} = \frac{\begin{bmatrix} -9 & -6 \\ -3 & -2 \end{bmatrix}}{0} = \infty$$

C^{-1} does not exist

(iv) $D = \begin{bmatrix} 1/2 & 3/4 \\ 1 & 2 \end{bmatrix}$

The multiplicative inverse of matrix B is calculated as:

$$D^{-1} = \frac{\text{Adj } D}{|D|}$$

$$\text{Adj } D = \begin{bmatrix} 2 & \frac{-3}{4} \\ -1 & \frac{1}{2} \end{bmatrix}$$

$$|D| = \begin{bmatrix} \frac{1}{2} & \frac{3}{4} \\ 1 & 2 \end{bmatrix}$$

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$$\begin{aligned}
 |D| &= \frac{1}{2} \times 2 - 1 \times \frac{1}{2} = 1 + \frac{3}{4} \\
 &= \frac{4-3}{4} = \frac{1}{4} \neq 0
 \end{aligned}$$

Since it is a non-singular matrix therefore solution is possible

$$\begin{aligned}
 D^{-1} &= \frac{\begin{bmatrix} 2 & -\frac{3}{4} \\ -1 & \frac{1}{2} \end{bmatrix}}{\frac{1}{4}} \\
 &= \begin{bmatrix} 2 \times 4 & -\frac{3}{4} \times 4 \\ -1 \times 4 & \frac{1}{2} \times 4 \end{bmatrix} \\
 &= \begin{bmatrix} 8 & -3 \\ -4 & 2 \end{bmatrix} \\
 D^{-1} &= \begin{bmatrix} 8 & -3 \\ -4 & 2 \end{bmatrix}
 \end{aligned}$$

Q4. If $A = \begin{bmatrix} 1 & 2 \\ 4 & 6 \end{bmatrix}$ and $B = \begin{bmatrix} 3 & -1 \\ 2 & -2 \end{bmatrix}$, then

(i) $A(\text{Adj } A) = (\text{Adj } A)A = (\det A)I$

(ii) $BB^{-1} = I = B^{-1}B$

Solution:

$$A = \begin{bmatrix} 1 & 2 \\ 4 & 6 \end{bmatrix}$$

(i) $A(\text{Adj } A) = (\text{Adj } A)A = (\det A)I$

$$\text{Adj } A = \begin{bmatrix} 6 & -2 \\ -4 & 1 \end{bmatrix}$$

$$\det A = \begin{bmatrix} 1 & 2 \\ 4 & 6 \end{bmatrix} = 1 \times 6 - 4 \times 2 = 6 - 8 = -2$$

Now, $A(\text{Adj } A)$

$$= \begin{bmatrix} 1 & 2 \\ 4 & 6 \end{bmatrix} \times \begin{bmatrix} 6 & -2 \\ -4 & 1 \end{bmatrix}$$

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$$\begin{aligned}
 &= \begin{bmatrix} 1 \times 6 + 2 \times (-4) & 1 \times (-2) + 2 \times 1 \\ 4 \times 6 + 6 \times (-4) & 4 \times (-2) + 6 \times 1 \end{bmatrix} \\
 &= \begin{bmatrix} 6 - 8 & -2 + 2 \\ 24 - 24 & -8 + 6 \end{bmatrix} \\
 &= \begin{bmatrix} -2 & 0 \\ 0 & -2 \end{bmatrix} \quad \text{----- (i)}
 \end{aligned}$$

$(Adj A) A$

$$\begin{aligned}
 &= \begin{bmatrix} 6 & -2 \\ -4 & 1 \end{bmatrix} \times \begin{bmatrix} 1 & 2 \\ 4 & 6 \end{bmatrix} \\
 &= \begin{bmatrix} 6 \times 1 + (-2) \times 4 & 6 \times 2 + (-2) \times 6 \\ -4 \times 1 + 1 \times 4 & -4 \times 2 + 1 \times 6 \end{bmatrix} \\
 &= \begin{bmatrix} 6 - 8 & 12 - 12 \\ -4 + 4 & -8 + 6 \end{bmatrix} \\
 &= \begin{bmatrix} -2 & 0 \\ 0 & -2 \end{bmatrix} \quad \text{----- (ii)}
 \end{aligned}$$

$(det A) I$

$$\begin{aligned}
 &= (-2) \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix} \\
 &= \begin{bmatrix} -2 & 0 \\ 0 & -2 \end{bmatrix} \quad \text{----- (iii)}
 \end{aligned}$$

From (i), (ii) and (iii), it is clear that:

$$A(Adj A) = (Adj A) A = (det A) I$$

(ii) $BB^{-1} = I = B^{-1}B$

As, $B^{-1} = \frac{Adj B}{|B|}$

$$Adj B = \begin{bmatrix} -2 & 1 \\ -2 & 3 \end{bmatrix}$$

$$det B = \begin{bmatrix} 3 & 1 \\ -2 & -2 \end{bmatrix} = 3 \times (-2) - 2 \times (-1)$$

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$$= -6 + 2 = -4 \neq 0$$

$$\begin{aligned} B^{-1} &= \frac{\begin{bmatrix} -2 & 1 \\ -2 & 3 \end{bmatrix}}{-4} = \begin{bmatrix} -2/-4 & 1/-4 \\ -2/-4 & 3/-4 \end{bmatrix} \\ &= \begin{bmatrix} 1/2 & -1/4 \\ 1/2 & -3/4 \end{bmatrix} \end{aligned}$$

Now, BB^{-1}

$$\begin{aligned} &= \begin{bmatrix} 3 & 1 \\ -2 & -2 \end{bmatrix} \times \begin{bmatrix} 1/2 & -1/4 \\ 1/2 & -3/4 \end{bmatrix} \\ &= \begin{bmatrix} 3 \times \left(\frac{1}{2}\right) + (-1) \times \left(\frac{1}{2}\right) & 3 \times \left(-\frac{1}{4}\right) + (-1) \times \left(-\frac{3}{4}\right) \\ 2 \times \left(\frac{1}{2}\right) + (-2) \times \left(\frac{1}{2}\right) & 2 \times \left(-\frac{1}{4}\right) + (-2) \times \left(-\frac{3}{4}\right) \end{bmatrix} \\ &= \begin{bmatrix} \frac{3}{2} - \left(\frac{1}{2}\right) & -\frac{3}{4} + \frac{3}{4} \\ 1 - 1 & -\frac{1}{2} + \frac{3}{2} \end{bmatrix} \\ &= \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix} = I \quad \text{----- (i)} \end{aligned}$$

Now, $B^{-1}B$

$$\begin{aligned} &= \begin{bmatrix} \frac{1}{2} & -\frac{1}{4} \\ \frac{1}{2} & -\frac{3}{4} \end{bmatrix} \times \begin{bmatrix} 3 & 1 \\ -2 & -2 \end{bmatrix} \\ &= \begin{bmatrix} \frac{1}{2} \times 3 + \left(-\frac{1}{4}\right) \times 2 & \frac{1}{2} \times (-1) + \left(-\frac{1}{4}\right) \times (-2) \\ \frac{1}{2} \times 3 + \left(-\frac{3}{4}\right) \times 2 & \frac{1}{2} \times (-1) + \left(-\frac{3}{4}\right) \times (-2) \end{bmatrix} \\ &= \begin{bmatrix} \frac{3}{2} - \frac{1}{2} & -\frac{1}{2} + \frac{1}{2} \\ \frac{3}{2} - \frac{3}{2} & -\frac{1}{2} + \frac{3}{2} \end{bmatrix} \\ &= \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix} = I \quad \text{----- (ii)} \end{aligned}$$

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From (i) and (ii), it is clear that:

$$BB^{-1} = I = B^{-1}B$$

Q5. Determine whether the given matrices are multiplicative inverses of each other.

(i) $\begin{bmatrix} 3 & 5 \\ 4 & 7 \end{bmatrix}$ and $\begin{bmatrix} 7 & -5 \\ -4 & 3 \end{bmatrix}$

(ii) $\begin{bmatrix} 1 & 2 \\ 2 & 3 \end{bmatrix}$ and $\begin{bmatrix} -3 & -3 \\ 2 & -1 \end{bmatrix}$

Solution:

(i) Let $A = \begin{bmatrix} 3 & 5 \\ 4 & 7 \end{bmatrix}$, and $B = \begin{bmatrix} 7 & -5 \\ -4 & 3 \end{bmatrix}$

$$\begin{aligned} AB &= \begin{bmatrix} 3 & 5 \\ 4 & 7 \end{bmatrix} \begin{bmatrix} 7 & -5 \\ -4 & 3 \end{bmatrix} \\ &= \begin{bmatrix} 3 \times 7 + 5 \times (-4) & 3 \times (-5) + 5 \times 3 \\ 4 \times 7 + 7 \times (-4) & 4 \times (-5) + 7 \times 3 \end{bmatrix} \\ &= \begin{bmatrix} 21 - 20 & -15 + 15 \\ 28 - 28 & -20 + 21 \end{bmatrix} \\ &= \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix} \\ &= I \quad (\text{identity matrix}) \end{aligned}$$

Hence the given matrices are multiplicative inverses of each other.

(ii) Let $A = \begin{bmatrix} 1 & 2 \\ 2 & 3 \end{bmatrix}$, and $B = \begin{bmatrix} -3 & -3 \\ 2 & -1 \end{bmatrix}$

$$\begin{aligned} AB &= \begin{bmatrix} 1 & 2 \\ 2 & 3 \end{bmatrix} \begin{bmatrix} -3 & -3 \\ 2 & -1 \end{bmatrix} \\ &= \begin{bmatrix} 1 \times (-3) + 2 \times 2 & 1 \times (-3) + 2 \times (-1) \\ 2 \times (-3) + 3 \times 2 & 2 \times (-3) + 3 \times (-1) \end{bmatrix} \\ &= \begin{bmatrix} -3 + 4 & -3 - 2 \\ -6 + 6 & -6 - 3 \end{bmatrix} \end{aligned}$$

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$$= \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$$

$$= I \quad (\text{identity matrix})$$

Hence the given matrices are multiplicative inverses of each other.

Q6. If $A = \begin{bmatrix} 4 & 0 \\ -1 & 2 \end{bmatrix}$, $B = \begin{bmatrix} -4 & -2 \\ 1 & -1 \end{bmatrix}$, $D = \begin{bmatrix} 3 & 1 \\ -2 & 2 \end{bmatrix}$. Then

verify that

(i) $(AB)^{-1} = B^{-1}A^{-1}$ (ii) $(DA)^{-1} = A^{-1}D^{-1}$

Solution:

(i) $(AB)^{-1} = B^{-1}A^{-1}$

As, $B^{-1} = \frac{\text{Adj } B}{|B|}$

$$\text{Adj } B = \begin{bmatrix} -1 & 2 \\ -1 & -4 \end{bmatrix}$$

$$\det B = \begin{vmatrix} -4 & -2 \\ 1 & -1 \end{vmatrix}$$

$$= -4 \times (-1) - 1 \times (-2) = 4 + 2 = 6 \neq 0$$

$$B^{-1} = \frac{\begin{bmatrix} -1 & 2 \\ -1 & -4 \end{bmatrix}}{6} = \begin{bmatrix} \frac{-1}{6} & \frac{2}{6} \\ \frac{-1}{6} & \frac{-4}{6} \end{bmatrix}$$

$$B^{-1} = \begin{bmatrix} \frac{-1}{6} & \frac{1}{3} \\ \frac{-1}{6} & \frac{-2}{3} \end{bmatrix} \quad \text{----- (a)}$$

Similarly, $A^{-1} = \frac{\text{Adj } A}{|A|}$

$$\text{Adj } A = \begin{bmatrix} 2 & -0 \\ 1 & 4 \end{bmatrix}$$

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$$\begin{aligned}\det A &= \begin{bmatrix} 4 & 0 \\ -1 & 2 \end{bmatrix} = 4 \times 2 - (-1) \times 0 \\ &= 8 + 0 = 8 \neq 0\end{aligned}$$

$$A^{-1} = \frac{\begin{bmatrix} 2 & -0 \\ 1 & 4 \end{bmatrix}}{8} = \begin{bmatrix} \frac{2}{8} & \frac{0}{8} \\ \frac{1}{8} & \frac{4}{8} \end{bmatrix}$$

$$A^{-1} = \begin{bmatrix} \frac{1}{4} & 0 \\ \frac{1}{8} & \frac{1}{2} \end{bmatrix} \text{----- (b)}$$

Now by solving L.H.S

$$\begin{aligned}&= (AB) \\ &= \left(\begin{bmatrix} 4 & 0 \\ -1 & 2 \end{bmatrix} \times \begin{bmatrix} -4 & -2 \\ 1 & -1 \end{bmatrix} \right) \\ &= \begin{bmatrix} 4 \times (-4) + 0 \times 1 & 4 \times (-2) + 0 \times (-1) \\ -1 \times (-4) + 2 \times 1 & (-1) \times (-2) + 2 \times (-1) \end{bmatrix} \\ &= \begin{bmatrix} -16 + 0 & -8 + 0 \\ 4 + 2 & 2 - 2 \end{bmatrix} \\ &= \begin{bmatrix} -16 & -8 \\ 6 & 0 \end{bmatrix}\end{aligned}$$

As, $(AB)^{-1} = \frac{\text{Adj } AB}{\det AB}$

$$\text{Adj } AB = \begin{bmatrix} 0 & -8 \\ 6 & -16 \end{bmatrix}$$

$$\begin{aligned}\det AB &= \begin{bmatrix} -16 & -8 \\ 6 & 0 \end{bmatrix} = -16 \times 0 - 6 \times (-8) \\ &= 0 + 48 = 48 \neq 0\end{aligned}$$

$$\text{So, } (AB)^{-1} = \frac{\begin{bmatrix} 0 & -8 \\ 6 & -16 \end{bmatrix}}{48} = \begin{bmatrix} \frac{0}{48} & \frac{-8}{48} \\ \frac{6}{48} & \frac{-16}{48} \end{bmatrix}$$

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$$(AB)^{-1} = \begin{bmatrix} 0 & -1 \\ \frac{1}{8} & \frac{-1}{3} \end{bmatrix} \text{----- (i)}$$

Now by solving R.H.S

$$\begin{aligned} &= B^{-1}A^{-1} \\ &= \begin{bmatrix} \frac{-1}{6} & \frac{1}{3} \\ \frac{-1}{6} & \frac{-2}{3} \end{bmatrix} \times \begin{bmatrix} \frac{2}{8} & \frac{0}{8} \\ \frac{1}{8} & \frac{4}{8} \end{bmatrix} \\ &= \begin{bmatrix} \frac{-1}{6} \times \frac{1}{4} + \frac{1}{3} \times \frac{1}{8} & \frac{-1}{6} \times 0 + \frac{1}{3} \times \frac{1}{2} \\ \frac{-1}{6} \times \frac{1}{4} + \frac{-2}{3} \times \frac{1}{8} & \frac{-1}{6} \times 0 + \frac{-2}{3} \times \frac{1}{2} \end{bmatrix} \\ &= \begin{bmatrix} \frac{-1}{24} + \frac{1}{24} & 0 + \frac{1}{6} \\ \frac{-1}{24} - \frac{1}{12} & 0 - \frac{1}{3} \end{bmatrix} \\ &= \begin{bmatrix} 0 & \frac{1}{6} \\ \frac{-1}{8} & \frac{-1}{3} \end{bmatrix} \text{----- (ii)} \end{aligned}$$

From (i) and (ii), it is clear that:

$$(AB)^{-1} = B^{-1}A^{-1}$$

$$(i) \quad (DA)^{-1} = A^{-1}D^{-1}$$

$$\begin{aligned} DA &= \begin{bmatrix} 3 & 1 \\ -2 & 2 \end{bmatrix} \times \begin{bmatrix} 4 & 0 \\ -1 & 2 \end{bmatrix} \\ &= \begin{bmatrix} 3 \times 4 + 1 \times (-1) & 3 \times 0 + 1 \times 2 \\ -2 \times 4 + 2 \times (-1) & -2 \times 0 + 2 \times 2 \end{bmatrix} \\ &= \begin{bmatrix} 12 - 1 & 0 + 2 \\ -8 - 2 & 0 + 4 \end{bmatrix} \\ &= \begin{bmatrix} 11 & 2 \\ -10 & 4 \end{bmatrix} \end{aligned}$$

$$\text{As, } (DA)^{-1} = \frac{\text{Adj } DA}{\det DA}$$

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$$\text{Adj DA} = \begin{bmatrix} 4 & -2 \\ 10 & 11 \end{bmatrix}$$

$$\begin{aligned} \det DA &= \begin{vmatrix} 11 & 2 \\ -10 & 4 \end{vmatrix} = -11 \times 4 - (-10) \times 2 \\ &= 44 + 20 = 64 \neq 0 \end{aligned}$$

$$\text{So, } (DA)^{-1} = \frac{\begin{bmatrix} 4 & -2 \\ 10 & 11 \end{bmatrix}}{64}$$

$$= \begin{bmatrix} \frac{4}{64} & \frac{-2}{64} \\ \frac{10}{64} & \frac{11}{64} \end{bmatrix}$$

$$= \begin{bmatrix} \frac{1}{16} & \frac{-1}{32} \\ \frac{5}{32} & \frac{11}{64} \end{bmatrix}$$

$$(DA)^{-1} = \begin{bmatrix} \frac{1}{16} & \frac{-1}{32} \\ \frac{5}{32} & \frac{11}{64} \end{bmatrix} \text{----- (i)}$$

$$A^{-1} = \frac{\text{Adj A}}{|A|}$$

$$\text{Adj A} = \begin{bmatrix} 2 & -0 \\ 1 & 4 \end{bmatrix}$$

$$\begin{aligned} \det A &= \begin{vmatrix} 4 & 0 \\ -1 & 2 \end{vmatrix} = 4 \times 2 - (-1) \times 0 \\ &= 8 + 0 = 8 \neq 0 \end{aligned}$$

$$A^{-1} = \frac{\begin{bmatrix} 2 & -0 \\ 1 & 4 \end{bmatrix}}{8}$$

$$= \begin{bmatrix} \frac{2}{8} & \frac{0}{8} \\ \frac{1}{8} & \frac{4}{8} \end{bmatrix}$$

$$A^{-1} = \begin{bmatrix} \frac{1}{4} & 0 \\ \frac{1}{8} & \frac{1}{2} \end{bmatrix} \text{----- (a)}$$

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$$D^{-1} = \frac{Adj D}{|D|}$$

$$Adj D = \begin{bmatrix} 2 & 1 \\ -2 & 3 \end{bmatrix}$$

$$\begin{aligned} \det D &= \begin{vmatrix} 3 & 1 \\ -2 & 2 \end{vmatrix} = 3 \times 2 - (-2) \times 1 \\ &= 6 + 2 = 8 \neq 0 \end{aligned}$$

$$D^{-1} = \frac{\begin{bmatrix} 2 & 1 \\ -2 & 3 \end{bmatrix}}{8} = \begin{bmatrix} \frac{2}{8} & \frac{1}{8} \\ \frac{-2}{8} & \frac{3}{8} \end{bmatrix}$$

$$D^{-1} = \begin{bmatrix} \frac{1}{4} & \frac{-1}{8} \\ \frac{1}{4} & \frac{3}{8} \end{bmatrix} \text{----- (b)}$$

Now by solving R.H.S

$$= A^{-1}D^{-1}$$

$$= \begin{bmatrix} \frac{1}{4} & 0 \\ \frac{1}{8} & \frac{1}{2} \end{bmatrix} \times \begin{bmatrix} \frac{1}{4} & \frac{-1}{8} \\ \frac{1}{4} & \frac{3}{8} \end{bmatrix}$$

$$= \begin{bmatrix} \frac{1}{4} \times \frac{1}{4} + 0 \times \frac{1}{4} & \frac{1}{4} \times \frac{-1}{8} + 0 \times \frac{3}{8} \\ \frac{1}{8} \times \frac{1}{4} + \frac{1}{2} \times \frac{1}{4} & \frac{1}{8} \times \frac{-1}{8} + \frac{1}{2} \times \frac{3}{8} \end{bmatrix}$$

$$= \begin{bmatrix} \frac{1}{16} + 0 & -\frac{1}{32} + 0 \\ \frac{1}{32} + \frac{1}{8} & -\frac{1}{64} + \frac{3}{16} \end{bmatrix}$$

$$= \begin{bmatrix} \frac{1}{16} & \frac{-1}{32} \\ \frac{5}{32} & \frac{11}{64} \end{bmatrix} \text{----- (ii)}$$

From (i) and (ii), it is clear that:

$$(DA)^{-1} = A^{-1}D^{-1}$$

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