# Exercise 1.5

**Q1. Find the determinant of the following matrices.**

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

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

**Solution:**

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

Determinant of matrix Ais calculated as:

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

**$|A|$ = 0 – 2 = - 2**

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

Determinant of matrix B is calculated as:

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

**$|B|$ = – 2 - 6 = - 8**

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

Determinant of matrix C is calculated as:

$|C|$ = det C = $\begin{bmatrix} 3 & 2 \\ 3 & 2 \end{bmatrix}$ = 3 x 2 - 2 x 3

**$|C|$ = 6 – 6 = 0**

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

Determinant of matrix D is calculated as:

$|D|$ = det D = $\begin{bmatrix} 3 & 2 \\ 1 & 4 \end{bmatrix}$ = 3 x 4 - 2 x 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 matric 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 = $\begin{bmatrix} 3 & 6 \\ 2 & 4 \end{bmatrix}$ = 3 x 4 - 2 x 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 = $\begin{bmatrix} 4 & 1 \\ 3 & 2 \end{bmatrix}$ = 4 x 2 - 1x 3

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

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

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

Determinant of matrix C is calculated as:

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

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

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

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

Determinant of matrix D is calculated as:

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

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

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)** **A =** $\begin{bmatrix} -1 & 3 \\ 2 & 0 \end{bmatrix}$ **(ii)** **B =** $\begin{bmatrix} 1 & 2 \\ -3 & -5 \end{bmatrix}$

**(iii)** **C =** $\begin{bmatrix} -2 & 6 \\ 3 & -9 \end{bmatrix}$ **(iv)** **D =** $\begin{bmatrix} 1/2 & 3/4 \\ 1 & 2 \end{bmatrix}$

**Solution:**

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

The multiplicative inverse of matrix A is calculated as:

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

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

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

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

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

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

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

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

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

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

The multiplicative inverse of matrix B is calculated as:

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

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

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

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

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

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

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

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



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

The multiplicative inverse of matrix C is calculated as:

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

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

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

$|C|$ = (-9) x (-2) – (-3) x (-6) = 18 - 18 = 0

Since it is a singular matrix therefore solution is not possible

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

$C^{-1}$ **does not exist**

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

The multiplicative inverse of matrix B is calculated as:

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

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

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

$|D| \quad = \quad \frac{1}{2} \times 2 - 1 \times \frac{1}{2} = 1 + \frac{3}{4}$

$= \quad \frac{4-3}{4} \quad = \quad \frac{1}{4} \neq 0$

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

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

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

$$= \begin{bmatrix} 8 & -3 \\ -4 & 2 \end{bmatrix}$$

$$\boldsymbol{D^{-1}} = \begin{bmatrix} \mathbf{8} & \mathbf{-3} \\ \mathbf{-4} & \mathbf{2} \end{bmatrix}$$

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

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

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

**Solution:**

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

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

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, $\boldsymbol{A(Adj\ A)}$

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

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

$$= \begin{bmatrix} 6-8 & -2+2 \\ 24-24 & -8+6 \end{bmatrix}$$

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

$(\boldsymbol{Adj\ A})\ \boldsymbol{A}$

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

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

$$= \begin{bmatrix} 6-8 & 12-12 \\ -4+4 & -8+6 \end{bmatrix}$$

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

$(\boldsymbol{det\ A})\ \boldsymbol{I}$

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

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

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

$$\boldsymbol{A(Adj\ A) = (Adj\ A)\ A = (det\ A)\ I}$$

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

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

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

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

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

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

$$= \quad \begin{bmatrix} 1/2 & -1/4 \\ 1/2 & -3/4 \end{bmatrix}$$

**Now,** $\boldsymbol{BB^{-1}}$

$$= \quad \begin{bmatrix} 3 & 1 \\ -2 & -2 \end{bmatrix} \times \begin{bmatrix} 1/2 & -1/4 \\ 1/2 & -3/4 \end{bmatrix}$$

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

$$= \quad \begin{bmatrix} \frac{3}{2} - \left(\frac{1}{2}\right) & -\frac{3}{4} + \frac{3}{4} \\ 1 - 1 & -\frac{1}{2} + \frac{3}{2} \end{bmatrix}$$

$$= \quad \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix} \quad = \quad I \qquad \text{------------- (i)}$$

**Now,** $\boldsymbol{B^{-1}B}$

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

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

$$= \quad \begin{bmatrix} \frac{3}{2} - \frac{1}{2} & -\frac{1}{2} + \frac{1}{2} \\ \frac{3}{2} - \frac{3}{2} & -\frac{1}{2} + \frac{3}{2} \end{bmatrix}$$

$$= \quad \begin{bmatrix} 1 & 1 \\ 0 & 0 \end{bmatrix} \quad = \quad I \qquad \text{------------ (ii)}$$

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 = $\begin{bmatrix} 7 & -5 \\ -4 & 3 \end{bmatrix}$

AB = $\begin{bmatrix} 3 & 5 \\ 4 & 7 \end{bmatrix}\begin{bmatrix} 7 & -5 \\ -4 & 3 \end{bmatrix}$

= $\begin{bmatrix} 3 \times 7 + 5 \times (-4) & 3 \times (-5) + 5 \times 3 \\ 4 \times 7 + 7 \times (-4) & 4 \times (-5) + 7 \times 3 \end{bmatrix}$

= $\begin{bmatrix} 21 - 20 & -15 + 15 \\ 28 - 28 & -20 + 21 \end{bmatrix}$

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

= $I$ (identity matrix)

Hence the given matrices are multiplicative inverses of each other.

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

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

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

= $\begin{bmatrix} -3 + 4 & 2 - 2 \\ -6 + 6 & 4 - 3 \end{bmatrix}$

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

$= \quad I$ (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, $B^{-1} = \frac{Adj\ B}{|B|}$

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

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

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

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

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

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

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

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

$= 8 + 0 = 8 \neq 0$

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

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

Now by solving L.H.S

$= (AB)$

$= \left( \begin{bmatrix} 4 & 0 \\ -1 & 2 \end{bmatrix} \times \begin{bmatrix} -4 & -2 \\ 1 & -1 \end{bmatrix} \right)$

$= \begin{bmatrix} 4 \times (-4) + 0 \times 1 & 4 \times (-2) + 0 \times (-1) \\ -1 \times (-4) + 2 \times 1 & (-1) \times (-2) + 2 \times (-1) \end{bmatrix}$

$= \begin{bmatrix} -16 + 0 & -8 + 0 \\ 4 + 2 & 2 - 2 \end{bmatrix}$

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

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

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

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

$= 0 + 48 = 48 \neq 0$

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

$(AB)^{-1} = \begin{bmatrix} 0 & \frac{-1}{6} \\ \frac{1}{8} & \frac{-1}{3} \end{bmatrix}$ ------------ (i)

Now by solving R.H.S

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

$= \begin{bmatrix} \frac{-1}{6} & \frac{1}{3} \\ \frac{-1}{6} & \frac{-2}{3} \end{bmatrix} \times \begin{bmatrix} \frac{2}{8} & \frac{0}{8} \\ \frac{1}{8} & \frac{4}{8} \end{bmatrix}$

$= \begin{bmatrix} \frac{-1}{6} \times \frac{1}{4} + \frac{1}{3} \times \frac{1}{8} & \frac{-1}{6} \times 0 + \frac{1}{3} \times \frac{1}{2} \\ \frac{-1}{6} \times \frac{1}{4} + \frac{-2}{3} \times \frac{1}{8} & \frac{-1}{6} \times 0 + \frac{-2}{3} \times \frac{1}{2} \end{bmatrix}$

$= \begin{bmatrix} \frac{-1}{24} + \frac{1}{24} & 0 + \frac{1}{6} \\ \frac{-1}{24} - \frac{1}{12} & 0 - \frac{1}{3} \end{bmatrix}$

$= \begin{bmatrix} 0 & \frac{1}{6} \\ \frac{-1}{8} & \frac{-1}{3} \end{bmatrix}$ -------------- (ii)

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

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

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

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

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

$= \begin{bmatrix} 12 - 1 & 0 + 2 \\ -8 - 2 & 0 + 4 \end{bmatrix}$

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

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

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

$\det DA = \begin{bmatrix} 11 & 2 \\ -10 & 4 \end{bmatrix} = -11 \times 4 - (-10) \times 2$

$= 44 + 20 = 64 \neq 0$

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

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

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

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

$A^{-1} = \dfrac{Adj\, A}{|A|}$

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

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

$= 8 + 0 = 8 \neq 0$

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

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

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

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

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

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

$$= 6 + 2 = 8 \neq 0$$

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

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

Now by solving R.H.S

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

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

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

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

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

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

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