EXPRESSWALA ACADEMY

Maths 1A: Inverse of a Matrix

MCQ Test, Set 05

Time: 30 minutes | Maximum marks: 25

Name: _____ Class: _____ Date: _____

1. There are 25 questions. Each has exactly one correct answer: choose A, B, C or D.
2. Each correct answer carries 1 mark. There is no negative marking.
3. The key sheet and worked solutions are at the end of this test.

1. The adjoint of $\begin{bmatrix} -6 & 7 \\ 2 & -2 \end{bmatrix}$ is

A. $\begin{bmatrix} -2 & -7 \\ -2 & -6 \end{bmatrix}$ **B.** $\begin{bmatrix} -2 & -2 \\ -7 & -6 \end{bmatrix}$

C. $\begin{bmatrix} -2 & 7 \\ 2 & -6 \end{bmatrix}$ **D.** $\begin{bmatrix} -6 & -7 \\ -2 & -2 \end{bmatrix}$

2. If $A = \begin{bmatrix} 2 & -1 & 4 \\ 5 & 4 & 4 \\ 0 & 2 & -3 \end{bmatrix}$, the element in row 2, column 1 of $\operatorname{Adj} A$ is

A. -15 **B.** 5 **C.** -5 **D.** 15

3. If A is a 3×3 matrix with $|A| = 3$, then $|(2A)^{-1}| =$

A. $\frac{1}{6}$ **B.** $\frac{1}{24}$ **C.** 24 **D.** $\frac{1}{12}$

4. If $A^{-1} = \begin{bmatrix} 3 & -2 \\ -4 & 5 \end{bmatrix}$, then $(3A)^{-1} =$

A. $\frac{1}{3}\begin{bmatrix} 3 & -2 \\ -4 & 5 \end{bmatrix}$ **B.** $\begin{bmatrix} 9 & -6 \\ -12 & 15 \end{bmatrix}$

C. $\frac{1}{3}\begin{bmatrix} 3 & -4 \\ -2 & 5 \end{bmatrix}$ **D.** $\frac{1}{9}\begin{bmatrix} 3 & -2 \\ -4 & 5 \end{bmatrix}$

5. If $A^{-1} = \begin{bmatrix} 1 & 4 \\ 0 & -1 \end{bmatrix}$ and $B^{-1} = \begin{bmatrix} -1 & -1 \\ 0 & 1 \end{bmatrix}$, then $(AB)^{-1} =$

A. $\begin{bmatrix} 0 & 3 \\ 0 & 0 \end{bmatrix}$ **B.** $\begin{bmatrix} -1 & 0 \\ -3 & -1 \end{bmatrix}$

C. $\begin{bmatrix} -1 & -3 \\ 0 & -1 \end{bmatrix}$ **D.** $\begin{bmatrix} -1 & 3 \\ 0 & -1 \end{bmatrix}$

6. The value of x for which $\begin{bmatrix} -1 & -1 & x \\ 4 & 2 & 4 \\ 2 & -2 & 2 \end{bmatrix}$ has no inverse is

A. 1 **B.** -2 **C.** -1 **D.** 0

7. $\begin{bmatrix} x & 4 \\ 2 & 6 \end{bmatrix}$ is singular when $x =$

A. $\frac{4}{3}$ **B.** $-\frac{4}{3}$ **C.** 12 **D.** $\frac{3}{4}$

8. The inverse of $\begin{bmatrix} 2 & 3 \\ 2 & 7 \end{bmatrix}$ is

A. $\frac{1}{8}\begin{bmatrix} 7 & 3 \\ 2 & 2 \end{bmatrix}$

B. $\frac{1}{8}\begin{bmatrix} 7 & -3 \\ -2 & 2 \end{bmatrix}$

C. $\frac{1}{8}\begin{bmatrix} 7 & -2 \\ -3 & 2 \end{bmatrix}$

D. $\frac{1}{8}\begin{bmatrix} 2 & -3 \\ -2 & 7 \end{bmatrix}$

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9. If $A = \begin{bmatrix} -1 & -4 \\ -3 & -3 \end{bmatrix}$, the element in row 1, column 2 of A^{-1} is

A. $\frac{1}{3}$ **B.** $\frac{4}{9}$ **C.** 4 **D.** $-\frac{4}{9}$

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10. If $A = \begin{bmatrix} 2 & 4 & 0 \\ -1 & -2 & 2 \\ 1 & 1 & 4 \end{bmatrix}$, the element in row 2, column 3 of A^{-1} is

A. $\frac{1}{2}$ **B.** -16 **C.** 1 **D.** -1

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11. If $\operatorname{Adj} A = \begin{bmatrix} -1 & -3 & 4 \\ 5 & 12 & -14 \\ -6 & -12 & 15 \end{bmatrix}$ and $|A| = 3$, then $A^{-1} =$

A. $-\frac{1}{3}\begin{bmatrix} -1 & -3 & 4 \\ 5 & 12 & -14 \\ -6 & -12 & 15 \end{bmatrix}$

B. $\frac{1}{3}\begin{bmatrix} -1 & -3 & 4 \\ 5 & 12 & -14 \\ -6 & -12 & 15 \end{bmatrix}$

C. $3\begin{bmatrix} -1 & -3 & 4 \\ 5 & 12 & -14 \\ -6 & -12 & 15 \end{bmatrix}$

D. $\frac{1}{3}\begin{bmatrix} -1 & 5 & -6 \\ -3 & 12 & -12 \\ 4 & -14 & 15 \end{bmatrix}$

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12. The inverse of $\begin{bmatrix} 5 & 0 & 0 \\ 0 & 2 & 0 \\ 0 & 0 & -2 \end{bmatrix}$ is

A. $\frac{1}{10}\begin{bmatrix} 2 & 0 & 0 \\ 0 & 5 & 0 \\ 0 & 0 & -5 \end{bmatrix}$

B. $\begin{bmatrix} -5 & 0 & 0 \\ 0 & -2 & 0 \\ 0 & 0 & 2 \end{bmatrix}$

C. $\frac{1}{10}\begin{bmatrix} -2 & 0 & 0 \\ 0 & -5 & 0 \\ 0 & 0 & 5 \end{bmatrix}$

D. $\begin{bmatrix} -4 & 0 & 0 \\ 0 & -10 & 0 \\ 0 & 0 & 10 \end{bmatrix}$

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13. $A = \frac{1}{11}\begin{bmatrix} 6 & 9 & -2 \\ 6 & -2 & 9 \\ 7 & -6 & -6 \end{bmatrix}$ is an orthogonal matrix. Then $A^{-1} =$

A. $\frac{1}{11}\begin{bmatrix} 6 & 9 & -2 \\ 6 & -2 & 9 \\ 7 & -6 & -6 \end{bmatrix}$

B. $\frac{1}{11}\begin{bmatrix} 6 & 6 & 7 \\ 9 & -2 & -6 \\ -2 & 9 & -6 \end{bmatrix}$

C. $\frac{1}{11}\begin{bmatrix} -6 & -9 & 2 \\ -6 & 2 & -9 \\ -7 & 6 & 6 \end{bmatrix}$

D. $\frac{1}{11}\begin{bmatrix} -6 & -6 & -7 \\ -9 & 2 & 6 \\ 2 & -9 & 6 \end{bmatrix}$

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14. If $A = \begin{bmatrix} 8 & 3 \\ -1 & 1 \end{bmatrix}$, then $A(\operatorname{Adj} A) =$

A. $-11I$ **B.** I **C.** $11I$ **D.** $121I$

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15. If A is a 2×2 matrix with $|A| = 5$, then $(\operatorname{Adj} A)A$ =

A. $\frac{1}{5}I$ **B.** $-5I$ **C.** $5I$ **D.** $25I$

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16. If A is a 3×3 matrix with $|A| = -2$, then $|\operatorname{Adj}(\operatorname{Adj} A)| =$

A. -32 **B.** -512 **C.** 4 **D.** 16

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17. For a square matrix A of order 3 (a 3×3 matrix), $|\operatorname{Adj} A| = 25$. Then $|A| =$

A. 625 only **B.** 5 or -5 **C.** 5 only **D.** 25 or -25

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18. If A is a non-singular matrix of order 4 and $|A| = 3$, then $\operatorname{Adj}(\operatorname{Adj} A) =$

A. $81A$ **B.** $9A$ **C.** $19683A$ **D.** $27A$

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19. If A is a square matrix of order 4, then $\operatorname{Adj}(-2A) =$

A. $-2 \operatorname{Adj} A$ **B.** $16 \operatorname{Adj} A$

C. $-32 \operatorname{Adj} A$ **D.** $-8 \operatorname{Adj} A$

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20. If $\operatorname{Adj} A = \begin{bmatrix} 3 & 3 \\ -4 & -3 \end{bmatrix}$ and $\operatorname{Adj} B = \begin{bmatrix} -2 & -1 \\ -3 & -3 \end{bmatrix}$, then $\operatorname{Adj}(AB) =$

A. $\begin{bmatrix} -2 & 3 \\ -3 & 0 \end{bmatrix}$ **B.** $\begin{bmatrix} -15 & -12 \\ 17 & 13 \end{bmatrix}$

C. $\begin{bmatrix} -2 & -3 \\ 3 & 0 \end{bmatrix}$ **D.** $\begin{bmatrix} 1 & 2 \\ -7 & -6 \end{bmatrix}$

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21. The characteristic equation of $\begin{bmatrix} 8 & 4 \\ 7 & 8 \end{bmatrix}$ is

A. $\lambda^2 - 16\lambda + 36 = 0$ **B.** $\lambda^2 - 16\lambda - 36 = 0$

C. $\lambda^2 - 36\lambda + 16 = 0$ **D.** $\lambda^2 + 16\lambda + 36 = 0$

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22. For $A = \begin{bmatrix} 1 & -1 & -1 \\ -2 & 1 & 4 \\ 1 & 3 & -1 \end{bmatrix}$, the value of S_2 in $\lambda^3 - S_1\lambda^2 + S_2\lambda - S_3 = 0$ is

A. -14 **B.** 14 **C.** 1 **D.** -8

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23. If $A^2 - 7A + 9I = O$, then $A^{-1} =$

A. $\frac{1}{7}(9I - A)$ **B.** $-\frac{1}{9}(7I - A)$ **C.** $\frac{1}{9}(-7I + A)$ **D.** $\frac{1}{9}(7I - A)$

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24. If $A = \begin{bmatrix} 5 & -2 \\ -2 & -4 \end{bmatrix}$ and $A^2 - kA + mI = O$, then $(k, m) =$

A. $(1, 24)$ **B.** $(-24, 1)$ **C.** $(1, -24)$ **D.** $(-1, -24)$

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25. If a non-singular 3×3 matrix A satisfies $A^3 + A^2 - 8A - 12I = O$, then $A^{-1} =$

A. $-\frac{1}{8}(A^2 + A + 12I)$ **B.** $\frac{1}{12}(A^2 - A - 8I)$

C. $-\frac{1}{12}(A^2 + A - 8I)$ **D.** $\frac{1}{12}(A^2 + A - 8I)$

Key sheet

1. A	**2.** D	**3.** B	**4.** A	**5.** C
6. C	**7.** A	**8.** B	**9.** D	**10.** D
11. B	**12.** A	**13.** B	**14.** C	**15.** C
16. D	**17.** B	**18.** B	**19.** D	**20.** C
21. A	**22.** A	**23.** D	**24.** C	**25.** D

Solutions

1. The adjoint of $\begin{bmatrix} -6 & 7 \\ 2 & -2 \end{bmatrix}$ is

For a 2×2 matrix, swap the diagonal entries and change the signs of the other two.

$\text{Adj } A = \begin{bmatrix} -2 & -7 \\ -2 & -6 \end{bmatrix}$

Ans: (A) $\begin{bmatrix} -2 & -7 \\ -2 & -6 \end{bmatrix}$

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2. If $A = \begin{bmatrix} 2 & -1 & 4 \\ 5 & 4 & 4 \\ 0 & 2 & -3 \end{bmatrix}$, the element in row 2, column 1 of $\text{Adj } A$ is

Row 2, column 1 of $\text{Adj } A$ is the cofactor A_{12} (the transpose).

$A_{12} = 15$

Ans: (D) 15

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3. If A is a 3×3 matrix with $|A| = 3$, then $|(2A)^{-1}| =$

$|2A| = (2)^3|A| = 24$

$|(2A)^{-1}| = \frac{1}{24}$

Ans: (B) $\frac{1}{24}$

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4. If $A^{-1} = \begin{bmatrix} 3 & -2 \\ -4 & 5 \end{bmatrix}$, then $(3A)^{-1} =$

$(kA)^{-1} = \frac{1}{k}A^{-1}$

$(3A)^{-1} = \frac{1}{3}\begin{bmatrix} 3 & -2 \\ -4 & 5 \end{bmatrix}$

Ans: (A) $\frac{1}{3}\begin{bmatrix} 3 & -2 \\ -4 & 5 \end{bmatrix}$

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5. If $A^{-1} = \begin{bmatrix} 1 & 4 \\ 0 & -1 \end{bmatrix}$ and $B^{-1} = \begin{bmatrix} -1 & -1 \\ 0 & 1 \end{bmatrix}$, then $(AB)^{-1} =$

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

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

Ans: (C) $\begin{bmatrix} -1 & -3 \\ 0 & -1 \end{bmatrix}$

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6. The value of x for which $\begin{bmatrix} -1 & -1 & x \\ 4 & 2 & 4 \\ 2 & -2 & 2 \end{bmatrix}$ has no inverse is

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

$x = -1$

Ans: (C) -1

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7. $\begin{bmatrix} x & 4 \\ 2 & 6 \end{bmatrix}$ is singular when $x =$

$|A| = 6x - 8 = 0$

$x = \frac{4}{3}$

Ans: (A) $\frac{4}{3}$

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8. The inverse of $\begin{bmatrix} 2 & 3 \\ 2 & 7 \end{bmatrix}$ is

$|A| = 8$

$A^{-1} = \frac{1}{8}\begin{bmatrix} 7 & -3 \\ -2 & 2 \end{bmatrix}$

Ans: (B) $\frac{1}{8}\begin{bmatrix} 7 & -3 \\ -2 & 2 \end{bmatrix}$

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9. If $A = \begin{bmatrix} -1 & -4 \\ -3 & -3 \end{bmatrix}$, the element in row 1, column 2 of A^{-1} is

$|A| = -9$

$A^{-1} = -\frac{1}{9}\begin{bmatrix} -3 & 4 \\ 3 & -1 \end{bmatrix}$

So the element is $-\frac{4}{9}$.

Ans: (D) $-\frac{4}{9}$

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10. If $A = \begin{bmatrix} 2 & 4 & 0 \\ -1 & -2 & 2 \\ 1 & 1 & 4 \end{bmatrix}$, the element in row 2, column 3 of A^{-1} is

$|A| = 4$

It is $\frac{A_{32}}{|A|} = \frac{-4}{4} = -1$

Ans: (D) -1

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11. If $\operatorname{Adj} A = \begin{bmatrix} -1 & -3 & 4 \\ 5 & 12 & -14 \\ -6 & -12 & 15 \end{bmatrix}$ and $|A| = 3$, then $A^{-1} =$

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

$= \frac{1}{3}\begin{bmatrix} -1 & -3 & 4 \\ 5 & 12 & -14 \\ -6 & -12 & 15 \end{bmatrix}$

Ans: (B) $\frac{1}{3}\begin{bmatrix} -1 & -3 & 4 \\ 5 & 12 & -14 \\ -6 & -12 & 15 \end{bmatrix}$

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12. The inverse of $\begin{bmatrix} 5 & 0 & 0 \\ 0 & 2 & 0 \\ 0 & 0 & -2 \end{bmatrix}$ is

$\operatorname{diag}(a, b, c)^{-1} = \operatorname{diag}\left(\frac{1}{a}, \frac{1}{b}, \frac{1}{c}\right)$

Ans: (A) $\frac{1}{10}\begin{bmatrix} 2 & 0 & 0 \\ 0 & 5 & 0 \\ 0 & 0 & -5 \end{bmatrix}$

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13. $A = \frac{1}{11}\begin{bmatrix} 6 & 9 & -2 \\ 6 & -2 & 9 \\ 7 & -6 & -6 \end{bmatrix}$ is an orthogonal matrix. Then $A^{-1} =$

For an orthogonal matrix, $A^{-1} = A^T$.

$A^{-1} = \frac{1}{11}\begin{bmatrix} 6 & 6 & 7 \\ 9 & -2 & -6 \\ -2 & 9 & -6 \end{bmatrix}$

Ans: (B) $\frac{1}{11}\begin{bmatrix} 6 & 6 & 7 \\ 9 & -2 & -6 \\ -2 & 9 & -6 \end{bmatrix}$

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14. If $A = \begin{bmatrix} 8 & 3 \\ -1 & 1 \end{bmatrix}$, then $A(\text{Adj } A) =$

$A(\text{Adj } A) = (\text{Adj } A)A = |A|\, I$

$|A| = 11$

Ans: (C) $11I$

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15. If A is a 2×2 matrix with $|A| = 5$, then $(\text{Adj } A)A$ =

$A(\text{Adj } A) = (\text{Adj } A)A = |A|\, I$

$= 5I$

Ans: (C) $5I$

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16. If A is a 3×3 matrix with $|A| = -2$, then $|\,\text{Adj}(\text{Adj } A)| =$

$|\,\text{Adj}(\text{Adj } A)| = |A|^{(n-1)^2}$

$= (-2)^4 = 16$

Ans: (D) 16

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17. For a square matrix A of order 3 (a 3×3 matrix), $|\,\text{Adj } A| = 25$. Then $|A| =$

$|\,\text{Adj } A| = |A|^2 = 25$

$|A| = 5 \text{ or } -5$

Ans: (B) 5 **or** -5

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18. If A is a non-singular matrix of order 4 and $|A| = 3$, then $\text{Adj}(\text{Adj } A) =$

$\text{Adj}(\text{Adj } A) = |A|^{n-2}A$

$= 9A$

Ans: (B) $9A$

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19. If A is a square matrix of order 4, then $\text{Adj}(-2A) =$

$\text{Adj}(kA) = k^{n-1}\ \text{Adj } A$

$= -8\ \text{Adj } A$

Ans: (D) $-8\ \text{Adj } A$

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20. If $\text{Adj}\, A = \begin{bmatrix} 3 & 3 \\ -4 & -3 \end{bmatrix}$ and $\text{Adj}\, B = \begin{bmatrix} -2 & -1 \\ -3 & -3 \end{bmatrix}$, then $\text{Adj}(AB) =$

$\text{Adj}(AB) = (\text{Adj}\, B)(\text{Adj}\, A)$

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

Ans: (C) $\begin{bmatrix} -2 & -3 \\ 3 & 0 \end{bmatrix}$

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21. The characteristic equation of $\begin{bmatrix} 8 & 4 \\ 7 & 8 \end{bmatrix}$ is

$|A - \lambda I| = \lambda^2 - (a+d)\lambda + (ad - bc) = 0$

$\lambda^2 - 16\lambda + 36 = 0$

Ans: (A) $\lambda^2 - 16\lambda + 36 = 0$

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22. For $A = \begin{bmatrix} 1 & -1 & -1 \\ -2 & 1 & 4 \\ 1 & 3 & -1 \end{bmatrix}$, the value of S_2 in $\lambda^3 - S_1\lambda^2 + S_2\lambda - S_3 = 0$ is

S_2 is the sum of the minors of the leading diagonal elements.

$S_2 = \begin{vmatrix} 1 & -1 \\ -2 & 1 \end{vmatrix} + \begin{vmatrix} 1 & 4 \\ 3 & -1 \end{vmatrix} + \begin{vmatrix} 1 & -1 \\ 1 & -1 \end{vmatrix} = -14$

Ans: (A) -14

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23. If $A^2 - 7A + 9I = O$, then $A^{-1} =$

Multiply by A^{-1}: $A - 7I + 9A^{-1} = O$

$A^{-1} = \frac{1}{9}(7I - A)$

Ans: (D) $\frac{1}{9}(7I - A)$

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24. If $A = \begin{bmatrix} 5 & -2 \\ -2 & -4 \end{bmatrix}$ and $A^2 - kA + mI = O$, then $(k, m) =$

$k = a + d = 1$

$m = ad - bc = -24$

Ans: (C) $(1, -24)$

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25. If a non-singular 3×3 matrix A satisfies $A^3 + A^2 - 8A - 12I = O$, then $A^{-1} =$

Multiply by A^{-1}: $A^2 + A - 8I = 12A^{-1}$

$A^{-1} = \frac{1}{12}(A^2 + A - 8I)$

Ans: (D) $\frac{1}{12}(A^2 + A - 8I)$