EXPRESSWALA ACADEMY

Maths 1A: Inverse of a Matrix

MCQ Test, Set 09

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. If $A = \begin{bmatrix} 4 & 4 \\ 9 & 1 \end{bmatrix}$, then $\operatorname{Adj} A =$

A. $\begin{bmatrix} 1 & -4 \\ -9 & 4 \end{bmatrix}$ **B.** $\begin{bmatrix} 1 & -9 \\ -4 & 4 \end{bmatrix}$

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

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

A. -29 **B.** 31 **C.** 29 **D.** -31

3. If A is a 2×2 matrix with $|A| = 4$, then $|(2A)^{-1}| =$

A. 16 **B.** $\frac{1}{8}$ **C.** $\frac{1}{16}$ **D.** $\frac{1}{2}$

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

A. $\frac{1}{4}\begin{bmatrix} 5 & 5 \\ -1 & 5 \end{bmatrix}$ **B.** $\frac{1}{2}\begin{bmatrix} 5 & -1 \\ 5 & 5 \end{bmatrix}$

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

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

A. $\begin{bmatrix} 4 & 5 \\ -5 & -6 \end{bmatrix}$ **B.** $\begin{bmatrix} -1 & 5 \\ 0 & -1 \end{bmatrix}$

C. $\begin{bmatrix} 3 & 1 \\ -2 & 2 \end{bmatrix}$ **D.** $\begin{bmatrix} -1 & 0 \\ 5 & -1 \end{bmatrix}$

6. The value of x for which $\begin{bmatrix} x & 5 & -3 \\ -1 & 1 & 1 \\ 0 & 3 & 1 \end{bmatrix}$ has no inverse is

A. 8 **B.** 7 **C.** 6 **D.** -7

7. $\begin{bmatrix} x & 9 \\ 4 & 6 \end{bmatrix}$ is singular when $x =$

A. $\frac{27}{2}$ **B.** $\frac{1}{6}$ **C.** 6 **D.** -6

8. The inverse of $\begin{bmatrix} 6 & 5 \\ -3 & -3 \end{bmatrix}$ is

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

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

C. $\frac{1}{3}\begin{bmatrix} 3 & -3 \\ 5 & -6 \end{bmatrix}$

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

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

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

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

A. $\frac{1}{3}$ **B.** $-\frac{1}{3}$ **C.** 12 **D.** $\frac{3}{2}$

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11. If $\operatorname{Adj} A = \begin{bmatrix} -3 & -1 & -7 \\ -2 & -2 & -10 \\ -2 & -2 & -6 \end{bmatrix}$ and $|A| = -4$, then $A^{-1} =$

A. $-\frac{1}{4}\begin{bmatrix} -3 & -1 & -7 \\ -2 & -2 & -10 \\ -2 & -2 & -6 \end{bmatrix}$

B. $-4\begin{bmatrix} -3 & -1 & -7 \\ -2 & -2 & -10 \\ -2 & -2 & -6 \end{bmatrix}$

C. $\frac{1}{4}\begin{bmatrix} -3 & -1 & -7 \\ -2 & -2 & -10 \\ -2 & -2 & -6 \end{bmatrix}$

D. $-\frac{1}{4}\begin{bmatrix} -3 & -2 & -2 \\ -1 & -2 & -2 \\ -7 & -10 & -6 \end{bmatrix}$

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12. The inverse of $\begin{bmatrix} 6 & 0 & 0 \\ 0 & -3 & 0 \\ 0 & 0 & -5 \end{bmatrix}$ is

A. $\begin{bmatrix} 15 & 0 & 0 \\ 0 & -30 & 0 \\ 0 & 0 & -18 \end{bmatrix}$

B. $\begin{bmatrix} -6 & 0 & 0 \\ 0 & 3 & 0 \\ 0 & 0 & 5 \end{bmatrix}$

C. $\frac{1}{30}\begin{bmatrix} -5 & 0 & 0 \\ 0 & 10 & 0 \\ 0 & 0 & 6 \end{bmatrix}$

D. $\frac{1}{30}\begin{bmatrix} 5 & 0 & 0 \\ 0 & -10 & 0 \\ 0 & 0 & -6 \end{bmatrix}$

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13. $A = \frac{1}{3}\begin{bmatrix} 2 & 1 & -2 \\ -2 & 2 & -1 \\ 1 & 2 & 2 \end{bmatrix}$ is an orthogonal matrix. Then $A^{-1} =$

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

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

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

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

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14. If $A = \begin{bmatrix} 0 & -1 \\ -3 & -2 \end{bmatrix}$, then $A(\text{Adj } A) =$

A. $3I$ **B.** $-3I$ **C.** I **D.** $9I$

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

A. $-27I$ **B.** $-3I$ **C.** $-\frac{1}{3}I$ **D.** $9I$

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

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

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17. If A is a 3×3 matrix and $|\text{Adj } A| = 25$, then $|A| =$

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

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18. If A is a non-singular matrix of order 4 and $|A| = -2$, then $\text{Adj}(\text{Adj } A) =$

A. $-8A$ **B.** $4A$ **C.** $-512A$ **D.** $16A$

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

A. $8 \text{ Adj } A$ **B.** $4 \text{ Adj } A$ **C.** $-2 \text{ Adj } A$ **D.** $2 \text{ Adj } A$

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20. If $\text{Adj } A = \begin{bmatrix} 2 & 2 \\ -4 & 4 \end{bmatrix}$ and $\text{Adj } B = \begin{bmatrix} 5 & -1 \\ 0 & -1 \end{bmatrix}$, then $\text{Adj}(AB) =$

A. $\begin{bmatrix} 10 & -4 \\ -20 & 0 \end{bmatrix}$ **B.** $\begin{bmatrix} 7 & 1 \\ -4 & 3 \end{bmatrix}$

C. $\begin{bmatrix} 14 & 6 \\ 4 & -4 \end{bmatrix}$ **D.** $\begin{bmatrix} 14 & 4 \\ 6 & -4 \end{bmatrix}$

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21. The characteristic equation of $\begin{bmatrix} 4 & -3 \\ -2 & 8 \end{bmatrix}$ is

A. $\lambda^2 + 12\lambda + 26 = 0$ **B.** $\lambda^2 - 12\lambda - 26 = 0$

C. $\lambda^2 - 12\lambda + 26 = 0$ **D.** $\lambda^2 - 26\lambda + 12 = 0$

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

A. 6 **B.** -4 **C.** -6 **D.** 1

23. If $A^2 - 3A + 10I = O$, then $A^{-1} =$

A. $\frac{1}{3}(10I - A)$ **B.** $\frac{1}{10}(-3I + A)$ **C.** $\frac{1}{10}(3I - A)$ **D.** $-\frac{1}{10}(3I - A)$

24. If $A = \begin{bmatrix} -2 & 6 \\ 0 & -4 \end{bmatrix}$ and $A^2 - kA + mI = O$, then $(k, m) =$

A. $(8, -6)$ **B.** $(6, 8)$ **C.** $(-6, -8)$ **D.** $(-6, 8)$

25. If a non-singular 3×3 matrix A satisfies $A^3 - 3A^2 - 6A + 8I = O$, then $A^{-1} =$

A. $-\frac{1}{8}(A^2 - 3A - 6I)$ **B.** $-\frac{1}{6}(A^2 - 3A - 8I)$

C. $\frac{1}{8}(A^2 - 3A - 6I)$ **D.** $-\frac{1}{8}(A^2 + 3A - 6I)$

Key sheet

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

Solutions

1. If $A = \begin{bmatrix} 4 & 4 \\ 9 & 1 \end{bmatrix}$, then $\text{Adj}\, A =$

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

$\text{Adj}\, A = \begin{bmatrix} 1 & -4 \\ -9 & 4 \end{bmatrix}$

Ans: (A) $\begin{bmatrix} 1 & -4 \\ -9 & 4 \end{bmatrix}$

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

Row 1, column 3 of $\text{Adj}\, A$ is the cofactor A_{31} (the transpose).

$A_{31} = -29$

Ans: (A) -29

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3. If A is a 2×2 matrix with $|A| = 4$, then $|(2A)^{-1}| =$

$|2A| = (2)^2|A| = 16$

$|(2A)^{-1}| = \frac{1}{16}$

Ans: (C) $\frac{1}{16}$

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

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

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

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

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

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

$= \begin{bmatrix} -1 & 5 \\ 0 & -1 \end{bmatrix}$

Ans: (B) $\begin{bmatrix} -1 & 5 \\ 0 & -1 \end{bmatrix}$

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6. The value of x for which $\begin{bmatrix} x & 5 & -3 \\ -1 & 1 & 1 \\ 0 & 3 & 1 \end{bmatrix}$ has no inverse is

$|A| = 14 - 2x = 0$

$x = 7$

Ans: (B) 7

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7. $\begin{bmatrix} x & 9 \\ 4 & 6 \end{bmatrix}$ is singular when $x =$

$|A| = 6x - 36 = 0$

$x = 6$

Ans: (C) 6

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8. The inverse of $\begin{bmatrix} 6 & 5 \\ -3 & -3 \end{bmatrix}$ is

$|A| = -3$

$A^{-1} = -\frac{1}{3}\begin{bmatrix} -3 & -5 \\ 3 & 6 \end{bmatrix}$

Ans: (D) $\frac{1}{3}\begin{bmatrix} 3 & 5 \\ -3 & -6 \end{bmatrix}$

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

$|A| = -5$

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

So the element is $\frac{1}{5}$.

Ans: (D) $\frac{1}{5}$

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

$|A| = -6$

It is $\frac{A_{13}}{|A|} = \frac{-2}{-6} = \frac{1}{3}$

Ans: (A) $\frac{1}{3}$

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11. If $\operatorname{Adj} A = \begin{bmatrix} -3 & -1 & -7 \\ -2 & -2 & -10 \\ -2 & -2 & -6 \end{bmatrix}$ and $|A| = -4$, then $A^{-1} =$

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

$= -\frac{1}{4}\begin{bmatrix} -3 & -1 & -7 \\ -2 & -2 & -10 \\ -2 & -2 & -6 \end{bmatrix}$

Ans: (A) $-\frac{1}{4}\begin{bmatrix} -3 & -1 & -7 \\ -2 & -2 & -10 \\ -2 & -2 & -6 \end{bmatrix}$

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12. The inverse of $\begin{bmatrix} 6 & 0 & 0 \\ 0 & -3 & 0 \\ 0 & 0 & -5 \end{bmatrix}$ is

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

Ans: (D) $\frac{1}{30}\begin{bmatrix} 5 & 0 & 0 \\ 0 & -10 & 0 \\ 0 & 0 & -6 \end{bmatrix}$

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13. $A = \frac{1}{3}\begin{bmatrix} 2 & 1 & -2 \\ -2 & 2 & -1 \\ 1 & 2 & 2 \end{bmatrix}$ is an orthogonal matrix. Then $A^{-1} =$

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

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

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

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14. If $A = \begin{bmatrix} 0 & -1 \\ -3 & -2 \end{bmatrix}$, then $A(\text{Adj } A) =$

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

$|A| = -3$

Ans: (B) $-3I$

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

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

$= -3I$

Ans: (B) $-3I$

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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. If A is a 3×3 matrix and $|\,\text{Adj } A| = 25$, 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 $|A| = -2$, then $\text{Adj}(\text{Adj } A) =$

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

$= 4A$

Ans: (B) $4A$

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

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

$= 2\ \text{Adj } A$

Ans: (D) $2\ \text{Adj } A$

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20. If $\text{Adj}\, A = \begin{bmatrix} 2 & 2 \\ -4 & 4 \end{bmatrix}$ and $\text{Adj}\, B = \begin{bmatrix} 5 & -1 \\ 0 & -1 \end{bmatrix}$, then $\text{Adj}(AB) =$

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

$= \begin{bmatrix} 5 & -1 \\ 0 & -1 \end{bmatrix} \begin{bmatrix} 2 & 2 \\ -4 & 4 \end{bmatrix} = \begin{bmatrix} 14 & 6 \\ 4 & -4 \end{bmatrix}$

Ans: (C) $\begin{bmatrix} 14 & 6 \\ 4 & -4 \end{bmatrix}$

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21. The characteristic equation of $\begin{bmatrix} 4 & -3 \\ -2 & 8 \end{bmatrix}$ is

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

$\lambda^2 - 12\lambda + 26 = 0$

Ans: (C) $\lambda^2 - 12\lambda + 26 = 0$

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22. For $A = \begin{bmatrix} 3 & 0 & 4 \\ 2 & -1 & 3 \\ -2 & -1 & -1 \end{bmatrix}$, 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.

$S_2 = \begin{vmatrix} 3 & 0 \\ 2 & -1 \end{vmatrix} + \begin{vmatrix} -1 & 3 \\ -1 & -1 \end{vmatrix} + \begin{vmatrix} 3 & 4 \\ -2 & -1 \end{vmatrix} = 6$

Ans: (A) 6

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23. If $A^2 - 3A + 10I = O$, then $A^{-1} =$

Multiply by A^{-1}: $A - 3I + 10A^{-1} = O$

$A^{-1} = \frac{1}{10}(3I - A)$

Ans: (C) $\frac{1}{10}(3I - A)$

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24. If $A = \begin{bmatrix} -2 & 6 \\ 0 & -4 \end{bmatrix}$ and $A^2 - kA + mI = O$, then $(k, m) =$

$k = a + d = -6$

$m = ad - bc = 8$

Ans: (D) $(-6, 8)$

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25. If a non-singular 3×3 matrix A satisfies $A^3 - 3A^2 - 6A + 8I = O$, then $A^{-1} =$

Multiply by A^{-1}: $A^2 - 3A - 6I = -8A^{-1}$

$A^{-1} = -\frac{1}{8}(A^2 - 3A - 6I)$

Ans: (A) $-\frac{1}{8}(A^2 - 3A - 6I)$