EXPRESSWALA ACADEMY

Maths 1A: Determinants

MCQ Test, Set 01

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. $\begin{vmatrix} 2 & -1 \\ -9 & 4 \end{vmatrix} =$

A. 17 **B.** -14 **C.** -1 **D.** 1

2. If $\begin{vmatrix} x & 4 \\ 1 & x \end{vmatrix} = 12$, then

A. $x = \pm 2\sqrt{2}$ **B.** $x = \pm 4$ **C.** $x = 4$ only **D.** $x = \pm 5$

3. The cofactor of the element 4 in $\begin{bmatrix} -1 & 0 & -6 \\ 4 & -6 & 1 \\ 9 & 5 & 9 \end{bmatrix}$ is

A. -29 **B.** 30 **C.** -30 **D.** -32

4. In $\begin{bmatrix} -5 & 3 & 2 \\ 4 & -1 & 9 \\ 0 & -6 & 8 \end{bmatrix}$, the minor M_{12} is

A. 36 **B.** -32 **C.** 32 **D.** 35

5. $\begin{vmatrix} -4 & 1 & 1 \\ -4 & 1 & 0 \\ 3 & 2 & 3 \end{vmatrix} =$

A. -11 **B.** 11 **C.** -35 **D.** -12

6. The value of $\begin{vmatrix} 3 & -2 & -4 \\ 0 & -1 & 5 \\ 5 & -4 & 5 \end{vmatrix}$ is

A. 25 **B.** 75 **C.** -15 **D.** -25

7. If $\begin{vmatrix} a & b & c \\ p & q & r \\ x & y & z \end{vmatrix} = 5$, then $\begin{vmatrix} a & 3b & c \\ p & 3q & r \\ x & 3y & z \end{vmatrix} =$

A. -15 **B.** 15 **C.** 5 **D.** 30

8. If $\begin{vmatrix} a & b & c \\ p & q & r \\ x & y & z \end{vmatrix} = -9$, then $\begin{vmatrix} p & q & r \\ x & y & z \\ a & b & c \end{vmatrix} =$

A. -27 **B.** 9 **C.** -18 **D.** -9

9. Using $C_3 \to C_3 - 12C_2$, the value of $\begin{vmatrix} 0 & 6 & 69 \\ 5 & 6 & 69 \\ 2 & 6 & 71 \end{vmatrix}$ is

A. -60 **B.** 60 **C.** -120 **D.** -50

10. Using $C_1 \to C_1 - 10C_2$, the value of $\begin{vmatrix} -26 & -3 & -4 \\ 39 & 4 & 0 \\ -15 & -2 & -1 \end{vmatrix}$ is

A. 118 **B.** -59 **C.** 59 **D.** 69

11. For $A = \begin{bmatrix} 3 & -3 & 1 \\ 3 & -4 & -5 \\ 1 & 0 & 1 \end{bmatrix}$ with cofactors A_{ij}, $a_{12}A_{13} + a_{22}A_{23} + a_{32}A_{33} =$

A. 32 **B.** -16 **C.** 0 **D.** 16

12. The roots of $\begin{vmatrix} x & -5 & 1 \\ -5 & x & 1 \\ -5 & 1 & x \end{vmatrix} = 0$ are

A. $-5,\ 1,\ 4$ **B.** $-5,\ 1,\ -4$ **C.** $-5,\ 1$ **D.** $5,\ -1,\ -4$

13. If A is a square matrix of order 3 and $|A| = 6$, then $|-2A| =$

A. -48 **B.** -12 **C.** 24 **D.** 48

14. If $|A| = 3$ for a matrix A of order 3, the determinant of the matrix of cofactors of A is

A. 27 **B.** -9 **C.** 3 **D.** 9

15. $\begin{vmatrix} 0 & -8 & -7 \\ 8 & 0 & 6 \\ 7 & -6 & 0 \end{vmatrix} =$

A. 149 **B.** 0 **C.** -48 **D.** 672

16. $\begin{vmatrix} 0 & -1 & 7 \\ 1 & 0 & 2 \\ -7 & -2 & 0 \end{vmatrix} =$

A. 54 **B.** 0 **C.** -2 **D.** -28

17. $\begin{vmatrix} 5 & 1 & 1 \\ 1 & 6 & 1 \\ 1 & 1 & 7 \end{vmatrix} =$

A. 194 **B.** 195 **C.** 135 **D.** 120

18. $\begin{vmatrix} 5 & 4 & 7 \\ 4 & 7 & 5 \\ 7 & 5 & 4 \end{vmatrix} =$

A. -112 **B.** -532 **C.** 952 **D.** 112

19. $\begin{vmatrix} p & q & r \\ q & r & p \\ r & p & q \end{vmatrix} =$

A. $(p+q+r)^3$ **B.** $p^3+q^3+r^3-3pqr$

C. $-(p^3+q^3+r^3)$ **D.** $-(p^3+q^3+r^3-3pqr)$

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20. Multiplying $\begin{vmatrix} 5 & 5 \\ -1 & 5 \end{vmatrix}$ and $\begin{vmatrix} -4 & 6 \\ 5 & 6 \end{vmatrix}$ row by row, the element in row 1, column 2 of the product is

A. -55 **B.** 34 **C.** 60 **D.** 55

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21. If $\Delta(x) = \begin{vmatrix} x^2 & 3x-2 \\ 4 & 1 \end{vmatrix}$, then $\Delta'(x) =$

A. 0 **B.** $2x-12$ **C.** $12-2x$ **D.** $4x-24$

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22. If $\Delta(x) = \begin{vmatrix} x^2 & e^{2x} \\ -2 & 2 \end{vmatrix}$, then $\Delta'(x) =$

A. $8x+8e^{2x}$ **B.** $4x+4e^{2x}$ **C.** 0 **D.** $-4x-4e^{2x}$

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23. $\int_0^1 \begin{vmatrix} 4x^3 & x^2+x \\ 1 & -1 \end{vmatrix} dx =$

A. $-\frac{11}{3}$ **B.** $\frac{11}{6}$ **C.** $-\frac{11}{6}$ **D.** $-\frac{5}{6}$

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24. $\begin{bmatrix} p & -5 \\ -12 & -3 \end{bmatrix}$ is singular when $p =$

A. 20 **B.** -40 **C.** -19 **D.** -20

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25. $\begin{bmatrix} p & -2 \\ 8 & 4 \end{bmatrix}$ is singular when $p =$

A. -8 **B.** 4 **C.** -4 **D.** -3

Key sheet

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

Solutions

1. $\begin{vmatrix} 2 & -1 \\ -9 & 4 \end{vmatrix} =$

$2 \cdot 4 - (-1) \cdot (-9) = -1$

Ans: (C) -1

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2. If $\begin{vmatrix} x & 4 \\ 1 & x \end{vmatrix} = 12$, then

$x^2 - 4 = 12$

$x^2 = 16 \Rightarrow x = \pm 4$

Ans: (B) $x = \pm 4$

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3. The cofactor of the element 4 in $\begin{bmatrix} -1 & 0 & -6 \\ 4 & -6 & 1 \\ 9 & 5 & 9 \end{bmatrix}$ is

$M_{21} = \begin{vmatrix} 0 & -6 \\ 5 & 9 \end{vmatrix} = 30$

$A_{21} = (-1)^3(30) = -30$

Ans: (C) -30

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4. In $\begin{bmatrix} -5 & 3 & 2 \\ 4 & -1 & 9 \\ 0 & -6 & 8 \end{bmatrix}$, the minor M_{12} is

$M_{12} = \begin{vmatrix} 4 & 9 \\ 0 & 8 \end{vmatrix} = 32 - 0 = 32$

Ans: (C) 32

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5. $\begin{vmatrix} -4 & 1 & 1 \\ -4 & 1 & 0 \\ 3 & 2 & 3 \end{vmatrix} =$

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

$= 4(3 - 2) + (-12 - 3)$

$= 4(1) + (-15) = -11$

Ans: (A) -11

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6. The value of $\begin{vmatrix} 3 & -2 & -4 \\ 0 & -1 & 5 \\ 5 & -4 & 5 \end{vmatrix}$ is

$\Delta = -\begin{vmatrix} 3 & -4 \\ 5 & 5 \end{vmatrix} - 5\begin{vmatrix} 3 & -2 \\ 5 & -4 \end{vmatrix}$

$= -(15 - (-20)) - 5(-12 - (-10))$

$= -(35) - 5(-2) = -25$

Ans: (D) -25

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7. If $\begin{vmatrix} a & b & c \\ p & q & r \\ x & y & z \end{vmatrix} = 5$, then $\begin{vmatrix} a & 3b & c \\ p & 3q & r \\ x & 3y & z \end{vmatrix} =$

One column is multiplied by 3, so the value is multiplied by 3.

$\therefore \text{value} = 3 \times 5 = 15$

Ans: (B) 15

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8. If $\begin{vmatrix} a & b & c \\ p & q & r \\ x & y & z \end{vmatrix} = -9$, then $\begin{vmatrix} p & q & r \\ x & y & z \\ a & b & c \end{vmatrix} =$

The rows are moved round once: two interchanges, so the sign changes twice.

$\therefore \text{value} = 1 \times (-9) = -9$

Ans: (D) -9

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9. Using $C_3 \to C_3 - 12C_2$, the value of $\begin{vmatrix} 0 & 6 & 69 \\ 5 & 6 & 69 \\ 2 & 6 & 71 \end{vmatrix}$ is

$C_3 \to C_3 - 12C_2$ leaves the value unchanged and gives $\begin{vmatrix} 0 & 6 & -3 \\ 5 & 6 & -3 \\ 2 & 6 & -1 \end{vmatrix}$.

$\Delta = -60$

Ans: (A) -60

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10. Using $C_1 \to C_1 - 10C_2$, the value of $\begin{vmatrix} -26 & -3 & -4 \\ 39 & 4 & 0 \\ -15 & -2 & -1 \end{vmatrix}$ is

$C_1 \to C_1 - 10C_2$ leaves the value unchanged and gives $\begin{vmatrix} 4 & -3 & -4 \\ -1 & 4 & 0 \\ 5 & -2 & -1 \end{vmatrix}$.

$\Delta = 59$

Ans: (C) 59

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11. For $A = \begin{bmatrix} 3 & -3 & 1 \\ 3 & -4 & -5 \\ 1 & 0 & 1 \end{bmatrix}$ with cofactors A_{ij}, $a_{12}A_{13} + a_{22}A_{23} + a_{32}A_{33} =$

Elements of one line times the cofactors of a different line give 0.

$a_{12}A_{13} + a_{22}A_{23} + a_{32}A_{33} = 0$

Ans: (C) 0

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12. The roots of $\begin{vmatrix} x & -5 & 1 \\ -5 & x & 1 \\ -5 & 1 & x \end{vmatrix} = 0$ are

$C_1 \to C_1 + C_2 + C_3$ gives the factor $x - 4$; then $R_2 - R_1$, $R_3 - R_1$ leave $(x + 5)(x - 1)$.

$x = -5,\ 1,\ 4$

Ans: (A) $-5,\ 1,\ 4$

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13. If A is a square matrix of order 3 and $|A| = 6$, then $|-2A| =$

$|-2A| = (-2)^3|A| = -48$

Ans: (A) -48

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14. If $|A| = 3$ for a matrix A of order 3, the determinant of the matrix of cofactors of A is

$|\text{cofactor matrix}| = |A|^{n-1} = 3^2 = 9$

Ans: (D) 9

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15. $\begin{vmatrix} 0 & -8 & -7 \\ 8 & 0 & 6 \\ 7 & -6 & 0 \end{vmatrix} =$

Skew-symmetric of odd order, so the determinant is 0.

Ans: (B) 0

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16. $\begin{vmatrix} 0 & -1 & 7 \\ 1 & 0 & 2 \\ -7 & -2 & 0 \end{vmatrix} =$

Skew-symmetric of odd order, so the determinant is 0.

Ans: (B) 0

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17. $\begin{vmatrix} 5 & 1 & 1 \\ 1 & 6 & 1 \\ 1 & 1 & 7 \end{vmatrix} =$

Result 9 with $a, b, c = 4, 5, 6$:

$abc\left(1 + \frac{1}{a} + \frac{1}{b} + \frac{1}{c}\right) = 120 + 30 + 24 + 20 = 194$

Ans: (A) 194

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18. $\begin{vmatrix} 5 & 4 & 7 \\ 4 & 7 & 5 \\ 7 & 5 & 4 \end{vmatrix} =$

Use result 1, $-(a^3 + b^3 + c^3 - 3abc)$ with $a, b, c = 5, 4, 7$.

$-(125 + 64 + 343 - 420) = -112$

Ans: (A) -112

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19. $\begin{vmatrix} p & q & r \\ q & r & p \\ r & p & q \end{vmatrix} =$

Result 1 (cyclic determinant) with $a, b, c = p, q, r$.

Ans: (D) $-(p^3 + q^3 + r^3 - 3pqr)$

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20. Multiplying $\begin{vmatrix} 5 & 5 \\ -1 & 5 \end{vmatrix}$ and $\begin{vmatrix} -4 & 6 \\ 5 & 6 \end{vmatrix}$ row by row, the element in row 1, column 2 of the product is

Row 1 of the first times row 2 of the second:

$5 \cdot 5 + 5 \cdot 6 = 55$

Ans: (D) 55

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21. If $\Delta(x) = \begin{vmatrix} x^2 & 3x-2 \\ 4 & 1 \end{vmatrix}$, then $\Delta'(x) =$

$\Delta'(x) = \begin{vmatrix} 2x & 3 \\ 4 & 1 \end{vmatrix} + \begin{vmatrix} x^2 & 3x-2 \\ 0 & 0 \end{vmatrix}$

$= 2x - 12$

Ans: (B) $2x - 12$

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22. If $\Delta(x) = \begin{vmatrix} x^2 & e^{2x} \\ -2 & 2 \end{vmatrix}$, then $\Delta'(x) =$

$\Delta'(x) = \begin{vmatrix} 2x & 2e^{2x} \\ -2 & 2 \end{vmatrix} + \begin{vmatrix} x^2 & e^{2x} \\ 0 & 0 \end{vmatrix}$

$= 4x + 4e^{2x}$

Ans: (B) $4x + 4e^{2x}$

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23. $\int_0^1 \begin{vmatrix} 4x^3 & x^2+x \\ 1 & -1 \end{vmatrix} dx =$

Only one row contains x, so integrate that row:

$\begin{vmatrix} \int_0^1 4x^3\,dx & \int_0^1 (x^2+x)\,dx \\ 1 & -1 \end{vmatrix} = \begin{vmatrix} 1 & \frac{5}{6} \\ 1 & -1 \end{vmatrix}$

$= -\frac{11}{6}$

Ans: (C) $-\frac{11}{6}$

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24. $\begin{bmatrix} p & -5 \\ -12 & -3 \end{bmatrix}$ is singular when $p =$

$-3p - 60 = 0$

$p = -20$

Ans: (D) -20

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25. $\begin{bmatrix} p & -2 \\ 8 & 4 \end{bmatrix}$ is singular when $p =$

$4p + 16 = 0$

$p = -4$

Ans: (C) -4
