EXPRESSWALA ACADEMY

Maths 1A: Determinants

MCQ Test, Set 08

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 value of $\begin{vmatrix} -6 & 7 \\ 6 & 4 \end{vmatrix}$ is

A. -64 **B.** 18 **C.** 66 **D.** -66

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

A. $x = -2$ only **B.** $x = \pm 2$ **C.** $x = \pm 3$ **D.** $x = 2$ only

3. The cofactor of the element 4 in $\begin{bmatrix} -6 & 8 & 9 \\ 9 & 0 & 7 \\ -5 & 4 & -1 \end{bmatrix}$ is

A. -39 **B.** 39 **C.** -123 **D.** 123

4. In $\begin{bmatrix} 0 & 3 & -3 \\ 6 & -3 & -1 \\ 1 & -4 & 2 \end{bmatrix}$, the minor M_{32} is

A. 18 **B.** -18 **C.** -3 **D.** 21

5. $\begin{vmatrix} 4 & 1 & -3 \\ 6 & -1 & 0 \\ 0 & 1 & 3 \end{vmatrix} =$

A. 48 **B.** -42 **C.** -48 **D.** -12

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

A. 130 **B.** 36 **C.** -130 **D.** -62

7. If $\begin{vmatrix} a & b & c \\ p & q & r \\ x & y & z \end{vmatrix} = 12$, then $\begin{vmatrix} a & b & c \\ 4p & 4q & 4r \\ x & y & z \end{vmatrix} =$

A. 12 **B.** 48 **C.** -48 **D.** 36

8. If $\begin{vmatrix} a & b & c \\ p & q & r \\ x & y & z \end{vmatrix} = 11$, then $\begin{vmatrix} b & a & c \\ q & p & r \\ y & x & z \end{vmatrix} =$

A. -22 **B.** -11 **C.** 33 **D.** 11

9. Using $C_2 \to C_2 - 9C_3$, the value of $\begin{vmatrix} 3 & 22 & 2 \\ -4 & 34 & 4 \\ 5 & 9 & 1 \end{vmatrix}$ is

A. 220 **B.** -110 **C.** 110 **D.** 120

10. $\begin{vmatrix} a-b & b-c & -a+c \\ b-c & -a+c & a-b \\ -a+c & a-b & b-c \end{vmatrix} =$

A. 1 **B.** 0 **C.** $a+b+c$ **D.** abc

11. For $A = \begin{bmatrix} 8 & -4 & 2 \\ 1 & 6 & 2 \\ 0 & 3 & 4 \end{bmatrix}$ with cofactors A_{ij}, $a_{21}A_{31} + a_{22}A_{32} + a_{23}A_{33} =$

A. 0 **B.** 332 **C.** -166 **D.** 166

12. The roots of $\begin{vmatrix} x & -3 & -3 \\ -3 & x & -3 \\ -3 & -3 & x \end{vmatrix} = 0$ are

A. $-3,\ -6$ **B.** $-3,\ 6$ **C.** $-3,\ 9$ **D.** $3,\ -6$

13. A, B are of order 3 with $|A| = -3$, $|B| = 2$. Then $|2AB| =$

A. -12 **B.** 48 **C.** -6 **D.** -48

14. If A is of order 3 and $|A| = -5$, then $|-A^T| =$

A. -15 **B.** 5 **C.** -5 **D.** 25

15. $\begin{vmatrix} 0 & -6 & -7 \\ 6 & 0 & -5 \\ 7 & 5 & 0 \end{vmatrix} =$

A. 30 **B.** 110 **C.** -420 **D.** 0

16. The determinant of a Hermitian matrix is

A. purely real **B.** always 1

C. purely imaginary **D.** always 0

17. $\begin{vmatrix} 10 & -6 & -12 \\ -6 & 5 & 8 \\ -12 & 8 & 17 \end{vmatrix} =$

A. 4 **B.** 29 **C.** 850 **D.** 30

18. $\begin{vmatrix} 1 & -3 & 9 \\ 1 & 5 & 25 \\ 1 & 7 & 49 \end{vmatrix} =$

A. -160 **B.** 64 **C.** 160 **D.** 1440

19. $\begin{vmatrix} x^2+1 & xy & xz \\ xy & y^2+1 & yz \\ xz & yz & z^2+1 \end{vmatrix} =$

A. $1+xyz$ **B.** $(1+x^2)(1+y^2)(1+z^2)$

C. $1+x^2+y^2+z^2$ **D.** $x^2+y^2+z^2$

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20. $\begin{vmatrix} 2 & 1 \\ 3 & -1 \end{vmatrix} \times \begin{vmatrix} 6 & 5 \\ 4 & 4 \end{vmatrix} =$

A. -1 **B.** 20 **C.** -18 **D.** -20

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

A. $3x^2+2x+2$ **B.** $-3x^2-2x-2$ **C.** $2x$ **D.** 2

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

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

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23. $\int_0^3 \begin{vmatrix} x^2 & x-1 \\ 6 & 4 \end{vmatrix} dx =$

A. 27 **B.** 28 **C.** -27 **D.** 81

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24. $\begin{bmatrix} p & 1 \\ -15 & -5 \end{bmatrix}$ is singular when $p =$

A. 4 **B.** 6 **C.** 3 **D.** -3

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25. If A and B are non-singular matrices of the same order, then AB is

A. always symmetric **B.** non-singular

C. the zero matrix **D.** singular

Key sheet

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

Solutions

1. The value of $\begin{vmatrix} -6 & 7 \\ 6 & 4 \end{vmatrix}$ is

$(-6)\cdot 4 - 7\cdot 6 = -66$

Ans: (D) -66

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

$x^2 - 16 = -12$

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

Ans: (B) $x = \pm 2$

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3. The cofactor of the element 4 in $\begin{bmatrix} -6 & 8 & 9 \\ 9 & 0 & 7 \\ -5 & 4 & -1 \end{bmatrix}$ is

$M_{32} = \begin{vmatrix} -6 & 9 \\ 9 & 7 \end{vmatrix} = -123$

$A_{32} = (-1)^5(-123) = 123$

Ans: (D) 123

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4. In $\begin{bmatrix} 0 & 3 & -3 \\ 6 & -3 & -1 \\ 1 & -4 & 2 \end{bmatrix}$, the minor M_{32} is

$M_{32} = \begin{vmatrix} 0 & -3 \\ 6 & -1 \end{vmatrix} = 0 - (-18) = 18$

Ans: (A) 18

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5. $\begin{vmatrix} 4 & 1 & -3 \\ 6 & -1 & 0 \\ 0 & 1 & 3 \end{vmatrix} =$

$\Delta = -6\begin{vmatrix} 1 & -3 \\ 1 & 3 \end{vmatrix} - \begin{vmatrix} 4 & -3 \\ 0 & 3 \end{vmatrix}$

$= -6(3 - (-3)) - (12 - 0)$

$= -6(6) - (12) = -48$

Ans: (C) -48

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

$\Delta = -2\begin{vmatrix} -3 & 1 \\ -1 & 6 \end{vmatrix} - 6\begin{vmatrix} -2 & 1 \\ 4 & 6 \end{vmatrix}$

$= -2(-18 - (-1)) - 6(-12 - 4)$

$= -2(-17) - 6(-16) = 130$

Ans: (A) 130

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7. If $\begin{vmatrix} a & b & c \\ p & q & r \\ x & y & z \end{vmatrix} = 12$, then $\begin{vmatrix} a & b & c \\ 4p & 4q & 4r \\ x & y & z \end{vmatrix} =$

One row is multiplied by 4, so the value is multiplied by 4.

$\therefore \text{value} = 4 \times 12 = 48$

Ans: (B) 48

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8. If $\begin{vmatrix} a & b & c \\ p & q & r \\ x & y & z \end{vmatrix} = 11$, then $\begin{vmatrix} b & a & c \\ q & p & r \\ y & x & z \end{vmatrix} =$

Interchanging two columns changes the sign.

$\therefore \text{value} = (-1) \times 11 = -11$

Ans: (B) -11

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9. Using $C_2 \to C_2 - 9C_3$, the value of $\begin{vmatrix} 3 & 22 & 2 \\ -4 & 34 & 4 \\ 5 & 9 & 1 \end{vmatrix}$ is

$C_2 \to C_2 - 9C_3$ leaves the value unchanged and gives $\begin{vmatrix} 3 & 4 & 2 \\ -4 & -2 & 4 \\ 5 & 0 & 1 \end{vmatrix}$.

$\Delta = 110$

Ans: (C) 110

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10. $\begin{vmatrix} a-b & b-c & -a+c \\ b-c & -a+c & a-b \\ -a+c & a-b & b-c \end{vmatrix} =$

$C_1 \to C_1 + C_2 + C_3$ makes the first column zero.

$\therefore \Delta = 0$

Ans: (B) 0

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11. For $A = \begin{bmatrix} 8 & -4 & 2 \\ 1 & 6 & 2 \\ 0 & 3 & 4 \end{bmatrix}$ with cofactors A_{ij}, $a_{21}A_{31} + a_{22}A_{32} + a_{23}A_{33} =$

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

$a_{21}A_{31} + a_{22}A_{32} + a_{23}A_{33} = 0$

Ans: (A) 0

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12. The roots of $\begin{vmatrix} x & -3 & -3 \\ -3 & x & -3 \\ -3 & -3 & x \end{vmatrix} = 0$ are

$\Delta = (x-6)(x+3)^2$

$x = -3 \text{ (twice)}$ or $x = 6$

Ans: (B) $-3,\ 6$

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13. A, B are of order 3 with $|A| = -3$, $|B| = 2$. Then $|2AB| =$

$|2AB| = 2^3|A|\,|B| = -48$

Ans: (D) -48

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14. If A is of order 3 and $|A| = -5$, then $|-A^T| =$

$|-A^T| = (-1)^3|A^T| = (-1)^3|A| = 5$

Ans: (B) 5

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15. $\begin{vmatrix} 0 & -6 & -7 \\ 6 & 0 & -5 \\ 7 & 5 & 0 \end{vmatrix} =$

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

Ans: (D) 0

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16. The determinant of a Hermitian matrix is

The determinant of a Hermitian matrix is purely real.

Ans: (A) purely real

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17. $\begin{vmatrix} 10 & -6 & -12 \\ -6 & 5 & 8 \\ -12 & 8 & 17 \end{vmatrix} =$

Result 10 with $a, b, c = -3, 2, 4$:

$1 + a^2 + b^2 + c^2 = 1 + 9 + 4 + 16 = 30$

Ans: (D) 30

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18. $\begin{vmatrix} 1 & -3 & 9 \\ 1 & 5 & 25 \\ 1 & 7 & 49 \end{vmatrix} =$

Use result 3, $(a-b)(b-c)(c-a)$ with $a, b, c = -3, 5, 7$.

$(-3-5)(5-7)(7-(-3)) = 160$

Ans: (C) 160

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19. $\begin{vmatrix} x^2+1 & xy & xz \\ xy & y^2+1 & yz \\ xz & yz & z^2+1 \end{vmatrix} =$

Result 10 with $a, b, c = x, y, z$.

Ans: (C) $1 + x^2 + y^2 + z^2$

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20. $\begin{vmatrix} 2 & 1 \\ 3 & -1 \end{vmatrix} \times \begin{vmatrix} 6 & 5 \\ 4 & 4 \end{vmatrix} =$

$(-5) \times 4 = -20$

This equals the determinant of the row by row product.

Ans: (D) -20

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

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

$= 3x^2 + 2x + 2$

Ans: (A) $3x^2 + 2x + 2$

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

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

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

Ans: (C) $4x - 2e^{2x}$

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23. $\int_0^3 \begin{vmatrix} x^2 & x-1 \\ 6 & 4 \end{vmatrix} dx =$

Only one row contains x, so integrate that row:

$\begin{vmatrix} \int_0^3 x^2\,dx & \int_0^3 (x-1)\,dx \\ 6 & 4 \end{vmatrix} = \begin{vmatrix} 9 & \frac{3}{2} \\ 6 & 4 \end{vmatrix}$

$= 27$

Ans: (A) 27

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24. $\begin{bmatrix} p & 1 \\ -15 & -5 \end{bmatrix}$ is singular when $p =$

$15 - 5p = 0$

$p = 3$

Ans: (C) 3

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25. If A and B are non-singular matrices of the same order, then AB is

$|AB| = |A|\,|B| \neq 0.$

Ans: (B) non-singular
