MATHS

BOOKS - NAGEEN MATHS (HINGLISH)

DETERMINANTS

Solved Examples

1. Find the value of the determinant $\begin{vmatrix} 3 & 4 & 7 \\ -1 & 6 & 5 \\ 2 & 8 & 10 \end{vmatrix}$

A. 1

B. 0

C. 2

D. -1

Answer: B

2. Find the value of the determinant $\begin{vmatrix} 1 & x & y+z \\ 1 & y & z+x \\ 1 & z & x+y \end{vmatrix}$

A. x+y+z

B. 0

C. (x+y)(y+z)(z+x)

D. (x-y)(y-z)(z-x)

Answer: B

3. Find the value of the determinant

$$\begin{vmatrix} \sqrt{13}+\sqrt{3} & 2\sqrt{5} & \sqrt{5} \\ \sqrt{26}+\sqrt{15} & 5 & \sqrt{10} \\ \sqrt{65}+3 & \sqrt{15} & 5 \end{vmatrix}$$

A. 0

B. 5

C. $\sqrt{15}$

D. $\sqrt{5}$

Answer:

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4. Without expanding, prove that :

$$\begin{vmatrix} 1+b & b+c & c+a \\ p+q & q+r & r+p \\ x+y & y+z & z+x \\ x+y & y+z & z+x \end{vmatrix} = 2\begin{vmatrix} a & b & c \\ p & q & r \\ x & y & z \end{vmatrix}$$

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5. Prove that :

$$= 2\begin{vmatrix} 1 & 1 & 1 \\ x & y & rz \\ x^2 & y^2 & z^2 \end{vmatrix} = (x-y)(y-z)(z-x)$$

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6. Prove that $\begin{vmatrix} 1 & b & c \\ a^2 & b^2 & c^2 \\ b+c & c+a & a+b \end{vmatrix} = (a-b)(b-c)(a+b+c)$

7. Prove that : $\begin{vmatrix} 1 & b & c \\ b & c & a \\ c & a & b \end{vmatrix} = 3abc - a^3 - b^3 - c^3$

8. Solve the equation $\begin{vmatrix} x+2 & 1 & -3 \\ 1 & x-3 & -2 \\ -3 & -2 & 1 \end{vmatrix} = 0.$

9. Prove that

$$\begin{vmatrix} 1 & x+\alpha & y+z-\alpha \\ 1 & t+\beta & +x-\beta \\ 1 & z+\gamma & x+y-\gamma \end{vmatrix} = 0$$

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10. if $\begin{vmatrix} 3 & 1 & -4 \\ 3 & 2 & 5 \\ 1 & -1 & 3 \end{vmatrix} = 49$, then evaluate $\begin{vmatrix} 6 & 3 & -\frac{8}{3} \\ 6 & 6 & \frac{10}{3} \\ 2 & -3 & 2 \end{vmatrix}$.

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11. Find the area of triangle whose vertices are (2,7), (1,1) and (10,8).

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12. Prove that the points (0,3), (4,6) and (-8, -3) are collinear.

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13. Find the equation of a line passing through the points (3,5) and (-2, 1).

14. If $A = \begin{vmatrix} 3 & 5 \\ 2 & 4 \end{vmatrix}$, find A^{-1}.

15. If $A = \begin{bmatrix} 3 & 2 & 1 \\ 0 & -1 & -2 \\ -3 & 4 & 2 \end{bmatrix}$, find A^{-1}

16. If $A = \begin{bmatrix} 1 & -1 \\ 2 & 3 \end{bmatrix}$, shown that $A^2 - 44 + 5I = o$. Hence Find A^{-1}.

17. Find a matrix B of order 2×2 such that :

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

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18. If $A = \begin{bmatrix} 3 & -3 & 4 \\ 2 & -3 & 4 \\ 0 & -1 & 1 \end{bmatrix}$, then show that $A^3 = A^{-1}$.

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19. Solve by matrix method :

$$2x + y = 5$$

$$x - y = 1$$

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20. Solve the following equations by matrix method.

$$2x + y + z = 1, \; x - 2y - 3z = 1 \; \text{and} \; 3x + 2y + 4z = 5$$

21. Use product $[1 - 120 2 - 3 3 - 24]$ $[-201 9 2 - 361 - 2]$ to solve the system of equation: $x - y + 2z = 1$ $2y - 3z = 1$ $3x - 2y + 4z = 2$

22. Find whether the following system of equation has a solution or not ?

x+5y=10 2x+10y=9

Exercise 4 A

1. Find the values of the following determinants
$$\begin{vmatrix} 3 & 4 \\ 1 & 2 \end{vmatrix}$$

2. Find the values of the following determinants

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

A. -13

B. 13

C. -17

D. None of these

Answer: A

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3. Find the values of the following determinants

$$\begin{vmatrix} 4 & 0 & 2 \\ 1 & 5 & -6 \\ 3 & -2 & 8 \end{vmatrix}$$

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4. Find the values of the following determinants

$$\begin{vmatrix} 1 & 1 & 1 \\ 5 & -3 & 1 \\ 7 & 4 & -2 \end{vmatrix}$$

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5. Find the values of the following determinants

$$\begin{vmatrix} 13 & 15 & 17 \\ 14 & 16 & 18 \\ 15 & 17 & 19 \end{vmatrix}$$

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6. Find the values of the following determinants

$$\begin{vmatrix} 12 & -10 & 5 \\ 3 & 2 & -1 \\ -4 & 0 & 3 \end{vmatrix}$$

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Exercise 4 B

1. Find the values of the following determinants :

(i) $\begin{vmatrix} 12 & 3 & 4 \\ 16 & 5 & 0 \\ 21 & -1 & 2 \end{vmatrix}$

(ii) $\begin{vmatrix} 256 & 240 & 219 \\ 240 & 225 & 198 \\ 219 & 198 & 181 \end{vmatrix}$

(iii) $\begin{vmatrix} 17 & 19 & 24 \\ 6 & 8 & 13 \\ -1 & 1 & 6 \end{vmatrix}$

(iv) $\begin{vmatrix} 67 & 19 & 21 \\ 39 & 13 & 14 \\ 81 & 24 & 26 \end{vmatrix}$

(v) $\begin{vmatrix} 1 & \omega & \omega^2 \\ \omega & \omega^2 & 1 \\ \omega^2 & \omega & 1 \end{vmatrix}$ where ω is a cube root of unity.

(iv) $\begin{vmatrix} 1 & x & y \\ 0 & \frac{2\pi}{5} & \frac{\sin(\pi)}{10} \\ 0 & \sin\left(\frac{2\pi}{5}\right) & \frac{\cos(\pi)}{10} \end{vmatrix}$

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2. Prove that : $\begin{vmatrix} a+b & b+c & c+a \\ c & a & b \\ 1 & 1 & 1 \end{vmatrix}$

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3. Without expending, prove that :

(i) $\begin{vmatrix} b^2c^2 & bc & b+c \\ c^2a^2 & ca & c+a \\ a^2b^2 & ab & a+b \end{vmatrix} = 0$

(ii) $\begin{vmatrix} x & y & z \\ x^2 & y^2 & z^2 \\ yz & zx & xy \end{vmatrix} = \begin{vmatrix} 1 & 1 & 1 \\ x^2 & y^2 & z^2 \\ x^3 & y^3 & z^3 \end{vmatrix}$

(iii) $\begin{vmatrix} 1 & 2x & x^2 - yz \\ 1 & y & y^2 - zx \\ 1 & z & z^2 - xy \end{vmatrix}$

$\left(\text{Taking 2, 3 and } \dfrac{2}{3}\text{common from } C_1, C_2 \text{ and } C_3 \text{ repectively} \right)$

$= 4 \times 49[\text{from eq.}(1)]$

=198.

(iv) $\begin{vmatrix} \sin x & \cos x & \sin(x+\alpha) \\ \sin y & \cos y & \sin(y+\alpha) \\ \sin z & \cos z & \sin(z+\alpha) \end{vmatrix} = 0$

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4. Prove that : $\begin{vmatrix} x+a & x+2a & x+3a \\ x+2a & x+3a & x+4a \\ x+4a & x+5a & x+6a \end{vmatrix} = 0$

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5. Find the value of : $\begin{vmatrix} 1 & x & yz \\ 1 & y & zx \\ 1 & z & xy \end{vmatrix}$

A. xyz(x+y+z)

B. (x-y)(y-z)(z-x)

C. xyz(x-y)(y-z)(z-x)

D. none of these

Answer: B

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6. The value of $Det \begin{bmatrix} x & x^2 & x^3 \\ y & y^2 & y^3 \\ z & z^2 & z^3 \end{bmatrix}$ will be

A. (x-y)(y-z)(z-x)

B. xyz(x-y)(y-z)(z-x)

C. -xyz(x-y)(y-z)(z-x)

D. None of these

Answer: B

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7. Prove that : $\begin{vmatrix} 1 & x & x^3 \\ 1 & y & y^3 \\ 1 & z & z^3 \end{vmatrix}$

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8. Prove that : $\begin{vmatrix} x+a & x & x \\ x & x+a & x \\ x & x & x+a \end{vmatrix} = a^2(3x+a)$

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9. Prove that : $\begin{vmatrix} x+a & b & c \\ a & x+b & c \\ a & b & x+c \end{vmatrix} = x^2(x+a+b+c)$

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10. Prove that :
$$\begin{vmatrix} x-y-z & 2x & 2x \\ 2y & y-z-x & 2y \\ 2z & 2z & z-x-y \end{vmatrix}$$

11. Prove that :
$$\begin{vmatrix} x+y+2z & x & y \\ z & y+z+2x & y \\ z & x & x+a+2y \end{vmatrix} = 2(x+y+)^3$$

12. Prove that :
$$\begin{vmatrix} (y+z)^2 & x^2 & x^2 \\ y^2 & (x+z)^2 & y^2 \\ z^2 & z^2 & (x+y)^2 \end{vmatrix} = 2xyz(x+y+z)^3$$

13. Prove that :
$$\begin{vmatrix} a+b & b & c \\ b+c & c & a \\ c+a & a & b \end{vmatrix} = 3abc - a^3 - b^3 - c^3$$

14. Prove that :

$$\begin{vmatrix} a^2 & b^2 + c^2 & bc \\ b^2 & c^2 + a^2 & ca \\ c^2 & a^2 + b^2 & ab \end{vmatrix} = -(a-b)(b-c)(c-a)(a+b+c)(a^2+b^2+c^2)$$

15. Prove that :

(i) $\begin{vmatrix} a & c & a+c \\ a+b & b & a \\ b & b+c & c \end{vmatrix} = 2abc$

(ii) Prove that : $\begin{vmatrix} a^2 & bc & ac+c^2 \\ a^2+ab & b^2 & ac \\ ab & b^2+bc & c^2 \end{vmatrix} = 4a^2b^2c^2$

16. Find the value of $\begin{vmatrix} a & b & c \\ a^2 & b^2 & c^2 \\ bc & ca & ab \end{vmatrix}$

A. (a-b)(b-c)(c-a)(ab+bc+ca)

B. (a-b)(b-c)(c-a)(ab+bc+ca)abc

C. (a-b)(b-c)(c-a)(a+b+c)

D. None of these

Answer: A

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17. Prove that : $\begin{vmatrix} 0 & a-b & a-c \\ b-a & 0 & b-c \\ c-a & c-b & 0 \end{vmatrix} = 0$

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18. Find the value of x

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

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19. (i) Solve the equation

$$\begin{vmatrix} x-2 & 2x-3 & 3x-4 \\ x-4 & 2x-9 & 3x-16 \\ x-8 & 2x-27 & 2x-64 \end{vmatrix} = 0$$

(ii) Prove that x = 1 is a root of the equation

(ii) Prove that x=1 is a root of the following equation

$$\begin{vmatrix} x+1 & 3 & 5 \\ 2 & x+2 & 5 \\ 2 & 3 & x+4 \end{vmatrix} = 0$$

Also find the remaining roots.

(iii) If a+b+c=0 then solve $\begin{vmatrix} a-x & c & b \\ c & b-x & a \\ v & a & c-x \end{vmatrix} = 0$

(iv) Solve $\begin{vmatrix} 6-x & 3 & 3 \\ 3 & 4-x & 5 \\ 3 & 5 & 4-5 \end{vmatrix} = 0$

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20. Solve the equation $\begin{vmatrix} x+a & c+b & x+c \\ x+b & x+c & x+a \\ x+c & x+a & x+b \end{vmatrix} = 0$

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21. One root of the equation $\begin{vmatrix} 3x-8 & 3 & 3 \\ 3 & 3x-8 & 3 \\ 3 & 3 & 3x-8 \end{vmatrix} = 0$ si(A)8/3

(B)2/3(C)1/3(D)16/3`

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22. If 2 s=a+b+c, then show that :

$\begin{vmatrix} a^2 & (s-a)^2 & (s-a)^2 \\ (s-b)^2 & b^2 & (s-b)^2 \\ (s-c)^2 & (s-c)^2 & c^2 \end{vmatrix} = 2s^3(s-a)(s-b)(s-c)$

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23. If the sides of a $\triangle ABC$ and a, b, c and

$\begin{vmatrix} a^2 & b^2 & c^2 \\ (a+1)^2 & (b+1)^2 & (c+1)^2 \\ (a-1)^2 & (b-1)^2 & (c-1)^2 \end{vmatrix} = 0$ then prove that $\triangle ABC$ is an isosceles triangle.

24. If the pth, qth and rth terms of a G.P, are x,y and z repectively, then

prove that $\begin{vmatrix} \log x & p & 1 \\ \log y & q & 1 \\ \log z & r & 1 \end{vmatrix} = 0$

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25. Prove that : $\begin{vmatrix} 1 & 1 & 1 \\ x & y & z \\ x^3 & y^3 & z^3 \end{vmatrix} = (x - y)(y - z)(x + y + z)$

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26. Prove that : $\begin{vmatrix} y + z & x & y \\ z + x & z & x \\ x + y & y & z \end{vmatrix} = (x + y + z)(x - z)^2$

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Exercise 4 C

1. Find the area of the triangle whose vertices are given below

$(-3, -4), (-2, -7), (-1, -9)$

A. 2sq.units

B. 1sq.units

C. $\dfrac{1}{2}$sq.units

D. $\dfrac{1}{4}$sq.units

Answer: C

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2. Using determinants, show that the following points are collinear :

(i) (a+b,c),(c+c,a),(c+a,b)

(ii) (5, 5),(10,7), (-5,1)

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3. If area of triangle is 35 sq units with vertices $(2, -6)$, $(5, 4) and (k, 4)$. Then k is(A) 12 (B) -2 (C) 12, 2 (D) 12, 2

4. If (x, y), $(a, 0)$, $(0, b)$ are collinear, then using determinants prove that $\dfrac{x}{a} + \dfrac{y}{b} = 1$.

5. If the value of k, is the points $(k, 2 - 2k)$, $(1 - k, 2k)$ and $(-4 - k, 6 - 2k)$ are collinear.

A. -1

B. $\dfrac{1}{2}$

C. 2

D. Both A and B

Answer: D

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6. Find the equation fo a line passing through the points (2,0) and (0,4).

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7. If the points $(a_1, b_1) m (a_2, b_2)$ and $(a_1 - a_2, b_2 - b_2)$ are collinear, then prove that $\dfrac{a_1}{a_2} = \dfrac{b_1}{b_2}$

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Exercise 4 D

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1. Are the following matrices invertible ?

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

(ii) $\begin{vmatrix} 7 & 0 \\ 3 & 1 \end{vmatrix}$

(iii) $\begin{vmatrix} 1 & -2 & -3 \\ 1 & -3 & -4 \\ 1 & -4 & -5 \end{vmatrix}$

(iv) $\begin{vmatrix} 2 & 3 & -1 \\ 0 & 1 & 4 \\ -5 & 0 & -2 \end{vmatrix}$

(v) $\begin{vmatrix} 0 & 1 & 2 \\ 1 & 2 & 3 \\ 3 & 1 & 1 \end{vmatrix}$

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2. Find the value of 'k' for which the following matrices are invertible ?

(i) $\begin{vmatrix} 6 & k \\ -2 & 1 \end{vmatrix}$

(ii) $\begin{vmatrix} 0 & k & 3 \\ 1 & -2 & 2 \\ 4 & 3 & -1 \end{vmatrix}$

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3. Find the inverse of the following matrices if exist :

(i) $\begin{vmatrix} 5 & -3 \\ 2 & 2 \end{vmatrix}$

(ii) $\begin{vmatrix} 1 & -3 \\ -1 & 2 \end{vmatrix}$

(iii) $\begin{vmatrix} 1 & 0 & -1 \\ 3 & 4 & 5 \\ 0 & -6 & -7 \end{vmatrix}$

(iv) $\begin{vmatrix} 1 & -3 & 3 \\ 2 & 2 & -4 \\ 2 & 0 & 2 \end{vmatrix}$

(v) $\begin{vmatrix} 1 & 2 & 1 \\ 1 & -1 & -2 \\ 1 & 2 & -1 \end{vmatrix}$

(vi) $\begin{vmatrix} 4 & -2 & -1 \\ 1 & 1 & -1 \\ -1 & 2 & 4 \end{vmatrix}$

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4. If $A = \begin{bmatrix} 3 & -1 \\ 1 & -3 \end{bmatrix}$ and B $= \begin{bmatrix} 2 & 1 \\ -1 & -2 \end{bmatrix}$, then show that:

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

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5. Find the inverse matrix of the matrix $A = \begin{vmatrix} \cos x & -\sin x & 0 \\ \sin x & \cos x & 0 \\ 0 & 0 & 1 \end{vmatrix}$

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6. If $A = \begin{vmatrix} 1 & 2 & 2 \\ 2 & 1 & 2 \\ 2 & 2 & 1 \end{vmatrix}$, then show that $A^2 - 4A - 5I_3 = 0$. Hemce find A^{-1}.

7. If $A = \begin{vmatrix} 4 & -1 & -4 \\ 3 & 0 & -4 \\ 3 & -1 & -3 \end{vmatrix}$, then show that $A = A^{-1}$

8. If $A = \begin{vmatrix} 1 & 4 & 5 \\ 3 & 2 & 6 \\ 0 & 1 & 0 \end{vmatrix}$, then evaluate A. (adj. A).

9. If $A = \begin{vmatrix} -3 & -1 & 2 \\ 2 & 2 & -3 \\ 1 & 3 & -1 \end{vmatrix}$, then show that :

A.(adj.A)=(adj.A). A.

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10. If $A = \begin{vmatrix} 1 & 1 & 1 \\ 1 & 2 & -3 \\ 2 & -1 & 3 \end{vmatrix}$, then show that A. (ajd.A)= (adj.A)A.

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11. $A = \begin{vmatrix} \cos x & -\sin x \\ \sin x & \cos x \end{vmatrix}$, then show that $\left(A^{-1}\right)^{-1} = A$.

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12. If $A = \begin{vmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{vmatrix}$ and $A = \begin{bmatrix} 0 & -3 & 4 \\ 1 & 2 & 3 \\ 0 & 5 & 5 \end{bmatrix}$, then find $(I - A)^{-1}$

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13. If $A^{-1} = \begin{vmatrix} 1 & 3 & 3 \\ 1 & 4 & 3 \\ 1 & 3 & 4 \end{vmatrix}$ and $\mathrm{B} = \begin{bmatrix} 5 & 0 & 4 \\ 2 & 3 & 2 \\ 1 & 2 & 1 \end{bmatrix}$, then find $(AB)^{-1}$

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1. Solve the following cquations by matrix method :

(i) 3x+y=10

x+3y=5

(ii) x+3y=11

3x-y=3.

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2. Solve the equations by matrix method: (i) x+y+z=6 x+y-z=0 2x+y+2x=10

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3. Solve the equations by matrix method : (i) x+2y+z=7 x+2y+z=7 x+3z=11

4. Test the consistency of the following system of equations : (i) 3x-y=2 6x-2y=4 (ii) x+5y=1 2x+2y=4 (iii) 2x-z=-1 6x-6y-2z=5 3x-y-2z=2

A. -1

B. 1

C. 0

D. None of these

Answer: A::B

Exercise 4 F

1. Choose the correct answer from the following :

The value of $\begin{vmatrix} -\cos\theta & \sin\theta \\ -\sin\theta & -\cos\theta \end{vmatrix}$ is:

A. -1

B. 1

C. 0

D. None of these

Answer: B

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2. Choose the correct answer from the following :

$\begin{vmatrix} x & 2 \\ 8 & x \end{vmatrix} = \begin{vmatrix} 6 & 8 \\ 9 & 12 \end{vmatrix}$, then x:

A. ± 6

B. ± 4

C. ± 2

D. None of these

Answer: B

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3. Choose the correct answer from the following :

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

A. -6

B. 18

C. -18

D. None of these

Answer: C

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4. Choose the correct answer from the following :

The value of $\begin{vmatrix} 1 & a & a^2 \\ 1 & b & b^2 \\ 1 & c & c^2 \end{vmatrix}$ $is:$

A. $(a - b)(b - c)(c - a)$

B. $-(a - b)(b - c)(c - a)$

C. $(a + b + c)(a - b)(b - c)(c - a)$

D. None of these

Answer: A

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5. Choose the correct answer from the following : The value of

$\begin{vmatrix} bc & -c^2 & ca \\ ab & ac & -a^2 \\ -b^2 & bc & ab \end{vmatrix}$ $is:$

A. $4abc$

B. $4a^2b^2c^2$

C. $4a^3b^3c^3$

D. None of these

Answer: B

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6. Choose the correct answer from the following :

If A is a matrix of order 3×3 and $|A| = 6$, then |adj.A|

A. 36

B. 216

C. 729

D. None of these

Answer: A

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7. Choose the correct answer from the following :

If a, b, c are in arithmetic progression, then
$$\begin{vmatrix} x+1 & x+4 & x+a \\ x+2 & x+5 & x+b \\ x+3 & x+6 & x+c \end{vmatrix} = $$

A. 2x

B. 1

C. 0

D. None of these

Answer: C

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8. Choose the correct answer from the following :

The verices of a triangle (2,-4), (-6,3) and (3,5). The area of triangle is :

A. $\dfrac{79}{2}$ sq.units

B. $\dfrac{81}{2}$ sq.units

C. $\dfrac{75}{5}$ sq.units

D. $\dfrac{85}{2}$ sq.units

Answer: A

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9. Choose the correct answer from the following :

If the points (p,7), (2,-5) and (6,3) are collinear, then p =

    A. 0

    B. 1

    C. 2

    D. None of these

Answer: D

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10. Choose the correct answer from the following :

The inverse of matrix $\begin{vmatrix} 1 & 3 \\ 2 & -1 \end{vmatrix}$ is :

A. $\dfrac{1}{7}\begin{vmatrix} 1 & 3 \\ 2 & -1 \end{vmatrix}$

B. $\dfrac{1}{7}\begin{vmatrix} -1 & 3 \\ 2 & 1 \end{vmatrix}$

C. $\dfrac{1}{7}\begin{vmatrix} 1 & -3 \\ -2 & -1 \end{vmatrix}$

D. $\dfrac{1}{7}\begin{vmatrix} -1 & -1 \\ 2 & 1 \end{vmatrix}$

Answer: A

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Exercise 4 G

1. If x+y+z=0=a+b+c, then $\begin{vmatrix} xa & yd & zc \\ yc & za & xb \\ zb & xc & ya \end{vmatrix} =$

A. 0

B. $xa + yb + zc$

C. 1

D. None of these

Answer: A

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2. $\begin{vmatrix} 1 & 1 & 1 \\ m_{C1} & m + 1_{C1} & m + 2_{C1} \\ m_{C2} & m + 1_{C2} & m + 2_{C2} \end{vmatrix} =$

A. 0

B. -1

C. -2

D. -3

Answer: B

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3. If $x \neq y \neq z$ and $\begin{vmatrix} x & x^2 & 1+x^3 \\ y & y^2 & 1+y^3 \\ z & z^2 & 1+z^3 \end{vmatrix} = 0$, then xyz =

A. 0

B. -1

C. -2

D. -3

Answer: B

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

A. 2

B. 1

C. 0

D. None of these

Answer: C

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5. For what value of 'K', the system of equations $kx + y + z = 1$, $x + ky + z = k$ and $x + y + kz = K^2$ has no solution ?

A. 0

B. -1

C. 1

D. None of these

Answer: D

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6. If $a \neq b \neq c$, then solution of equation

$$\begin{vmatrix} x-a & x-b & x-c \\ x-b & x-c & x-a \\ x-c & x-a & x-a \end{vmatrix} = 0 \quad is:$$

A. $x = 0$

B. $x = a + b + c$

C. $x = \dfrac{1}{2}(a + b + c)$

D. $x = \dfrac{1}{3}(a + b + c)$

Answer: D

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7. One root of the equation $\begin{vmatrix} 3-x & -6 & 3 \\ -6 & 3-x & 3 \\ 3 & 3 & -6-x \end{vmatrix} = 0 \quad is:$

A. 6

B. 3

C. 0

D. None of these

Answer: C

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8. $\begin{vmatrix} \sin^2 x & \cos x^2 x & 1 \\ \cos^2 x & \sin^2 x & 1 \\ -10 & 12 & 2 \end{vmatrix} = 0$

A. 0

B. $12\cos^2 x - 10\sin^2 x$

C. $12\sin^2 x - 10\cos^2 x - 2$

D. $10\sin 2x$

Answer: A

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9.

$0 < 0 < \dfrac{\pi}{2}$ and $\begin{vmatrix} 1 + \sin^2 \theta & \cos^2 \theta & 4 \sin 4\theta \\ \sin^2 \theta & 1 + \cos^2 \theta & 4 \sin \theta \\ \sin^2 \theta & \cos^2 \theta & 1 + 4 \sin \theta \end{vmatrix} =$, then $\theta =$

A. $\dfrac{\pi}{24}, \dfrac{5\pi}{24}$

B. $\dfrac{5\pi}{24}, \dfrac{7\pi}{24}$

C. $\dfrac{7\pi}{24}, \dfrac{11\pi}{24}$

D. None of these

Answer: C

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10. If a, b, c are positive real numbers, then for the system of equations

$$\dfrac{x^2}{a^2} + \dfrac{y^2}{b^2} - \dfrac{z^2}{c^2} = 1, \quad \dfrac{x^2}{a^2} - \dfrac{y^2}{b^2} + \dfrac{z^2}{c^2} = 1, \quad -\dfrac{x^2}{a^2} + \dfrac{y^2}{b^2} + \dfrac{z^2}{c^2} = 1$$

there is :

A. no solution

B. exactly one solution

C. infinite solutions

D. None of these

Answer: B

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1. Evalute the determinants in queations 1 and 2 :

$$\begin{bmatrix} 2 & 4 \\ -5 & -1 \end{bmatrix}$$

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2. Evalute the determinants in queations 1 and 2 :

(i) $\begin{bmatrix} \cos\theta & -\sin\theta \\ \sin\theta & \cos\theta \end{bmatrix}$

(ii) $\begin{vmatrix} x^2 & -x+1 & x-1 \\ x+1 & & x+1 \end{vmatrix}$

3. Evalute the determinants in queations 1 and 2 :

If $A = \begin{bmatrix} 1 & 2 \\ 4 & 2 \end{bmatrix}$, then show that $|2A|=4|A|$.

4. Evalute the determinants in queations 1 and 2 : If $A = \begin{vmatrix} 1 & 0 & 1 \\ 0 & 1 & 2 \\ 0 & 0 & 4 \end{vmatrix}$

5. Evalute the determinants :

(i) $\begin{vmatrix} 3 & -1 & -2 \\ 0 & 0 & 1 \\ 3 & -5 & 0 \end{vmatrix}$

(ii) $\begin{vmatrix} 3 & -4 & 5 \\ 1 & 1 & -2 \\ 2 & 3 & 1 \end{vmatrix}$

(iii) $\begin{vmatrix} 0 & 1 & 2 \\ -1 & 0 & -3 \\ -2 & 3 & 0 \end{vmatrix}$

(iv) $\begin{vmatrix} 2 & -1 & -2 \\ 0 & 2 & -1 \\ 3 & -5 & 0 \end{vmatrix}$

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6. Evaluate the determinant of :

If $A = \begin{vmatrix} 1 & 1 & -2 \\ 2 & 1 & -3 \\ 5 & 4 & -9 \end{vmatrix}$, find $|A|$.

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7. Find the values of x, if

(i) $\begin{vmatrix} 2 & 4 \\ 5 & 1 \end{vmatrix} = \begin{vmatrix} 2x & 4 \\ 6 & x \end{vmatrix}$

(ii) $\begin{vmatrix} 2 & 3 \\ 4 & 5 \end{vmatrix} = \begin{vmatrix} x & 3 \\ 2x & 5 \end{vmatrix}$

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8. If $\begin{vmatrix} x & 2 \\ 18 & x \end{vmatrix} = \begin{vmatrix} 6 & 2 \\ 18 & 6 \end{vmatrix}$, find x.

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Exercise 4 2

1. Using the property of determinants and without expanding in questions 1 to 7 prove that ,

$$\begin{vmatrix} x & a & x+a \\ y & b & y+b \\ z & c & z+c \end{vmatrix} = 0$$

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2. Using the property of determinants and without expanding in questions 1 to 7 prove that ,

$$\begin{vmatrix} a-b & b-c & c-a \\ b-c & c-a & a-b \\ c-a & a-b & b-c \end{vmatrix} = 0$$

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3. Using the property of determinants and without expanding, prove that

$$\begin{vmatrix} 2 & 7 & 65 \\ 3 & 8 & 75 \\ 5 & 9 & 86 \end{vmatrix} = 0$$

4. Using the property of determinants and without expanding, prove that:

$$\begin{vmatrix} 1 & bc & a(b+c) \\ 1 & ca & b(c+a) \\ 1 & ab & x(a+b) \end{vmatrix} = 0$$

5. Using the property of determinants and without expanding, prove that:

$$\begin{vmatrix} b+c & q+r & y+z \\ c+a & r+p & z+x \\ a+b & p+q & x+y \end{vmatrix} = 2 \begin{vmatrix} a & p & x \\ b & q & y \\ c & r & z \end{vmatrix}$$

6. Using the property of determinants and without expanding, prove that:

$$|0a - b - a0 - cbc0| = 0$$

7. Using the property of determinants and without expanding, prove that:

$$| - a^2\,abacbab^2\,bacb - c^2| = 4a^2b^2c^2$$

8. By using properties of determinants. Show that:(i)

$$|1aa^21 \; \hat{} \; 21 \; \hat{} \; 2| = (a - b)(b - c)(c - a)\text{(ii)}$$

$$|111abca^3b^3c^3| = (a - b)(b - c)(c - a)(a + b + c)$$

9. By using properties of determinants. Show that:

$$\left| x^2 \; yzyy^2 \; zxzz^2 \; xy \right| = (x-y)(y-z)(z-x)(xy+yz+zx)$$

10. By using properties of determinants. Show that: (i)

$$|x + 42x2x2 \times \; + 42x2x2 \times \; + 4| = (5x-4)(4-x)^2 \qquad \text{(ii)}$$

$$|y + kyyyy + kyyyy + k| = k^2\left(2yk\right)^2$$

11. By using properties of determinants. Show that:(i)

$$|a - b - c2a2a2 - c - a2b2c2 - a - b| = (a+b+c)^3 \qquad \text{(ii)}$$

$$|x + y + 2zxyzy + z + 2xyzxz + x + 2y| = 2(x+y+z)^3$$

12. Using properties of determinants, prove the following:

$$\left|1 \times^2 x^2 1 \times x^2 1\right| = \left(1 - x^3\right)^2$$

---

13. By using properties of determinants. Show that:

$$\left|1 + a^2 - b^2 2ab - 2b 2ab 1 - a^2 + b^2 2a 2b - 2a 1 - a^2 - b^2\right| = \left(1 + a^2 + b^2\right)$$

---

14. Using properties of determinants, prove the following:

$$\left|a^2 ab ac a \char`\^ 2 + 1 bac b c^2 + 1\right| = 1 + a^2 + b^2 + c^2.$$

---

15. Let A be a square matrix of order 3×3, then $|kA|$is equal to(A) $k|A|$

(B) $k^2|A|$ (C) $K^3|A|$ (D) $3k|A|$

16. Which of the following is correct (A) Determinant is a square matrix. (B) Determinant is a number associated to a matrix. (C) Determinant is a number associated to a square matrix. (D) None of these

Exercise 4 3

1. Find area of the triangle with vertices at the point given in each of the following : (i) (1,0), (6,0), (4,3) (ii) (2,7), (1,1), (10,8)

2. Show that points $A(a, b + c), B(b, c + a), C(c, a + b)$ are collinear.

3. Find the values of k if area of tringle is 4 sq. units and dvertices are : (i)

(k,0), (4,0), (0,2)

4. (i) Find the equation of line joining (1,2) and (3,4) using determinants,

(ii) Find the equation of the line joining (3,1) and (9,3) using determinants.

5. If area of triangle is 35 sq units with vertices $(2, -6), (5, 4) and (k, 4)$.

Then k is(A) 12 (B) -2 (C) 12, 2 (D) 12, 2

Exercise 4 4

1. Write Minors and Cofactors of the elements of following determinants:

(i) $\begin{vmatrix} 2 & -4 \\ 0 & 3 \end{vmatrix}$ (ii) $\begin{vmatrix} a & c \\ b & d \end{vmatrix}$

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2. Write minors and cofactors of the elements of the determinants:

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

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3. Using Cofactors of elements of second row, evaluate $\Delta = \begin{vmatrix} 5 & 3 & 8 \\ 2 & 0 & 1 \\ 1 & 2 & 3 \end{vmatrix}$

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4. Using Cofactors of elements of third column, evaluate

$\Delta = \begin{vmatrix} 1 & x & yz \\ 1 & y & zx \\ 1 & z & xy \end{vmatrix}$

5. If $\Delta = |a_{11}a_{12}a_{13}a_{21}a_{22}a_{23}a_{31}a_{32}a_{33}|$ and A_{ij} is cofactors of a_{ij} , then

value of Δ is given by (A) $a_{11} + A_{31} + a_{12}A_{32} + a_{13}A_{33}$ (B)

$a_{11}A_{11} + a_{12}A_{21} + a_{13}A_{31}$ (C) `a_(21)A

Exercise 4 5

1. Find the adjoint of each of the matrices $\begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix}$

2. Find the adjoint of each of the matrices $\begin{bmatrix} 1 & -1 & 2 \\ 2 & 3 & 5 \\ -2 & 0 & 1 \end{bmatrix}$

3. Varify A (adjA)=(adjA)A=|A| I $\begin{bmatrix} 2 & 3 \\ -4 & -6 \end{bmatrix}$

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4. Varify A (adjA)=(adjA)A $\begin{bmatrix} 1 & -1 & 2 \\ 3 & 0 & -2 \\ 1 & 0 & 3 \end{bmatrix} =$

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5. Find the inverse the matrix (if it exists)given in$[2 - 243]$

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6. Find the inverse the matrix (if it exists)given in$[-15 - 32]$

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7. Find the inverse the matrix (if it exists)given in $\begin{bmatrix} 1 & 2 & 3 \\ 0 & 2 & 4 \\ 0 & 0 & 5 \end{bmatrix}$

8. Find the inverse the matrix (if it exists)given in $\begin{bmatrix} 1 & 0 & 0 \\ 3 & 3 & 0 \\ 5 & 2 & -1 \end{bmatrix}$

9. Find the inverse the matrix (if it exists) given in

$$\begin{bmatrix} 2 & 1 & 3 \\ 4 & -1 & 0 \\ -7 & 2 & 1 \end{bmatrix}$$

10. Find the inverse the matrix (if it exists)given in $\begin{bmatrix} 1 & -1 & 2 \\ 0 & 2 & -3 \\ 3 & -2 & 4 \end{bmatrix}$

11. Find the inverse the matrix (if it exists)given in

$$[0000 \cos \alpha \sin \alpha 0 \sin \alpha - \cos \alpha]$$

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12. If $A = [3275]$ and $B = [6789]$, verify that $(AB)^{-1} = B^{-1}A^{-1}$.

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13. If $A = \begin{bmatrix} 3 & 1 \\ -1 & 2 \end{bmatrix}, I = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$ and $O = \begin{bmatrix} 0 & 0 \\ 0 & 0 \end{bmatrix}$, show that $A^2 - 5A + 7I = 0.$ Hence find $A^{-1}.$

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14. Solve system of linear equations, using matrix method,

$$xy + 2z = 7 \qquad\qquad 3x + 4y + 5z = 5$$

$$2xy + 3\ z = 12$$

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15. For the matrix $A = [1 1 1 1 2 - 3 2 1 3]$. Show that $A^3 - 6A^2 + 5A + 11I = 0$. Hence, find A^{-1}.

16. If $A = [2 - 1 1 - 1 2 - 1 1 - 1 2]$. Verify that $A^3 - 6A^2 + 9A - 4I = O$ and hence find A^{-1}.

17. Let A be a non-singular square matrix of order 3 × 3. Then |adj A| is equal to (a) $|A|$ (B) $|A|^2$ (C) $|A|^3$ (D) $3|A|$

18. If A is an invertible matrix of order 2, then det (A^{-1}) is equal to(a) det

(A) (B) $\dfrac{1}{\det(A)}$ (C) 1 (D) 0

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Exercise 4 6

1. Examine the consistency of the system of equations$x + 2y = 2$

$2x + 3y = 3$

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2. Examine the consistency of the system of equations$2x - y = 5$

$x + y = 4$

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3. Examine the consistency of the system of equations

$x + 3y = 5, 2x + 6y = 8$

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4. Examine the consistency of the system of equations

$x + y + z = 1$

$2x + 3y + 2z = 2$

$ax + ay + 2az = 4$

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5. Examine the consistency of the system of equations $3x y 2z = 22yz = 1$

$3x 5y = 3$

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6. Examine the consistency of the system of equations in questions 1 to 6.

5x-y+4z=5, 2x+3y+5z=2, 5x-2y+6z=-1

7. Solve system of linear equations, using matrix method, $5x + 2y = 4$, $7x + 3y = 5$

8. Solve system of linear equations, using matrix method,

$$2x - y = -2$$

$$3x + 4y = 3$$

9. Solve system of linear equations, using matrix method,

$$4x - 3y = 3$$

$$3x - 5y = 7$$

10. Solve system of linear equations, using matrix method,

$$5x + 2y = 3$$

$$3x + 2y = 5$$

11. Solve system of linear equations, using matrix method,

$$2x + y + z = 1$$

$$x - 2y - z = \frac{3}{2}$$

$$3y - 5z = 9$$

12. Solve system of linear equations, using matrix method,

$$x - y + z = 4,$$

$$2x + y - 3z = 0,$$

$$x + y + z = 2$$

13. Solve system of linear equations, using matrix method,

$$2x + 3y + 3z = 5$$

$$x - 2y + z = -4$$

$$3x - y - 2z = 3$$

14. Solve system of linear equations, using matrix method, in questions 7 to 14.

x-y+2z=7, 3x+4y-5z=-5, 2x-y+3z=12

15. If $A = \begin{pmatrix} 2 & -3 & 5 \\ 3 & 2 & -4 \\ 1 & 1 & -2 \end{pmatrix}$ find A^{-1}. Use it to solve the system of

equations $\quad 2x - 3y + 5z = 11 \quad , \quad 3x + 2y - 4z = -5 \quad$ and

$x + y - 2z = -3$

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16. The cost of 4 kg onion, 3 kg wheat and 2 kg rice is Rs 60. The cost of 2 kg onion, 4 kg wheat and 6 kg rice is Rs 90. The cost of 6 kg onion 2 kg wheat and 3 kg rice is Rs 70. Find cost of each item per kg by matrix method.

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Miscellaneous Exercise

1. Prove that the determinant $[x \sin\theta \cos\theta - \sin\theta - x1\cos\theta1x]$ is independent of 0.

2. Show without expanding at any stage that:
$$[a, a^2, bc], [b, b^2, ca], [c, c^2, ab]| = |[1, a^2, a^3], [1, b^2, b^3], [1, c^2, c^3]|$$

3. Evaluate
$$\begin{vmatrix} \cos\alpha\cos\beta & \cos\alpha\sin\beta & -\sin\alpha \\ -\sin\beta & \cos\beta & 0 \\ \sin\alpha\cos\beta & \sin\alpha\sin\beta & \cos\alpha \end{vmatrix}$$

4. If a, b and c are real numbers, and
$$\Delta = |b + + aa + bc + aa + + ca + + + a| = 0$$ .Show that either

$$a + b + c = 0 \quad \text{or} \quad a = b = c.$$

5. Solve the equation:
$$\begin{vmatrix} x+a & b & c \\ a & x+b & c \\ a & b & x+c \end{vmatrix} = 0$$

6. Using properties of determinants, prove that
$$\begin{vmatrix} a^2 & bc & ac+c^2 \\ a^2+ab & b^2 & ac \\ ab & b^2+bc & c^2 \end{vmatrix} = 4a^2b^2c^2$$

7. If $A^{-1} = [3 - 11 - 156 - 55 - 22]$ and $B = [12 - 2 - 1300 - 21]$, find $(AB)^{-1}$.

8. Let $A = \begin{bmatrix} 1 & -2 & 1 \\ -2 & 3 & 1 \\ 1 & 1 & 5 \end{bmatrix}$. Verify that ltbtgt (i) $[adjA]^{-1} = adj(A^{-1})$

(ii) $\left(A^{-1} \,\hat{}\, (-1)\right) = A$

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9. Evaluate: $\begin{bmatrix} x & y & x+y \\ y & x+y & x \\ x+y & x & y \end{bmatrix}$

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10. Evaluate the following: $\begin{vmatrix} 1 & x & y \\ 1 & x+y & y \\ 1 & x & x+y \end{vmatrix}$

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11. Using peoperties of determinants in questions 11 to 15, prove that :

$$\begin{vmatrix} \alpha & \alpha^2 & \beta + \gamma \\ \beta & \beta^2 & \gamma + \alpha \\ \gamma & \gamma^2 & \alpha + \beta \end{vmatrix} = (\beta - \gamma)(\gamma - \alpha)(\alpha - \beta + \gamma)$$

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12. Prove that $\begin{bmatrix} x & x^2 & 1 + px^3 \\ y & y^2 & 1 + py^3 \\ z & z^2 & 1 + pz^3 \end{bmatrix} = (1 + pxyz)(x - y)(y - z)(z - x)$

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13. Show that:

$$|3a - a + b - a + c - b + a3b - b + c - c + a - c + b3c| = 3(a + b + c)($$

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14. Show that

$$|11 + p1 + p + q23 + 2p1 + 3p + 2q36 + 3p106p + 3q| = 1.$$

15. Show that $\begin{vmatrix} \sin\alpha & \cos\alpha & \cos(\alpha+\delta) \\ \sin\beta & \cos\beta & \cos(\beta+\delta) \\ \sin\gamma & \cos\gamma & \cos(\gamma+\delta) \end{vmatrix} = 0$

16. Solve the system of equations $\dfrac{2}{x} + \dfrac{3}{y} + \dfrac{10}{z} = 4 \dfrac{4}{x} - \dfrac{6}{y} + \dfrac{5}{z} = 1$ $\dfrac{6}{x} + \dfrac{9}{y} - \dfrac{20}{z} = 2$

17. Choose the correct answer in questions 17 to 19:

If a, b, c are in A.P., then the determinant $\begin{bmatrix} x+2 & x+3 & x+2a \\ x+3 & x+4 & x+3b \\ x+4 & x+5 & x+2c \end{bmatrix}$ is :

(a) 0

(b) 1

(c) x

(d) 2x

18. Choose the correct answer in questions 17 to 19:

If x, y, z are nonzero real numbers then the inverse of metrix

$$A = \begin{bmatrix} x & 0 & 0 \\ 0 & y & 0 \\ 0 & 0 & z \end{bmatrix} \text{ is :}$$

(a) $\begin{bmatrix} x^{-1} & 0 & 0 \\ 0 & y^1 & 0 \\ 0 & 0 & z^1 \end{bmatrix}$

(b) $xyz \begin{bmatrix} x^{-1} & 0 & 0 \\ 0 & y^1 & 0 \\ 0 & 0 & z^1 \end{bmatrix}$

(c) $\dfrac{1}{xyz} \begin{bmatrix} x & 0 & 0 \\ 0 & y & 0 \\ 0 & 0 & z \end{bmatrix}$

(d) $\dfrac{1}{xyz} \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$

19. Let $A = |1 \sin \theta 1 - \sin \theta 1 \sin \theta - 1 - \sin \theta 1|$, where $0 \leq \theta \leq 2\pi$.

Then $Det(A) = 0$ (b) $Det(A) \in (2, \infty)$ $Det(A) \in (2, 4)$ (d)

$Det(A) \in [2, 4]$

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