MATHS

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DETERMINANTS

Exercise

1. If $A^2 - A + I = 0, A^{-1} = ?$

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2. Consider $\Delta = \begin{vmatrix} \alpha & \beta & \gamma \\ \alpha^2 & \beta^2 & \gamma^2 \\ \beta+\gamma & \gamma+\alpha & \alpha+\beta \end{vmatrix}$ Apply $R_3 \to R_1 + R_3$

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3. Consider $\Delta = \begin{vmatrix} \alpha & \beta & \gamma \\ \alpha^2 & \beta^2 & \gamma^2 \\ \beta+\gamma & \gamma+\alpha & \alpha+\beta \end{vmatrix}$ Show that $\Delta = (\alpha-\beta)(\beta-\gamma)(\gamma-\alpha)(\alpha+\beta+\gamma)$.

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4. If $\begin{vmatrix} 3 & x \\ x & x \end{vmatrix} = \begin{vmatrix} -2 & 2 \\ 4 & 1 \end{vmatrix}$, find the value of x.

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

Calculate $|A|$

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6. $A = \begin{bmatrix} 1 & -3 & 1 \\ 2 & 0 & 4 \\ 1 & 2 & -2 \end{bmatrix}$ Find |adj A|

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

Find $|3A|$

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

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

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10. Without expanding the determinant prove the following.

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

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11. If a,b,c are in A.P, find value of

$$\begin{vmatrix} 2y+4 & 5y+7 & 8y+a \\ 3y+5 & 6y+8 & 9y+b \\ 4y+6 & 7y+9 & 10y+c \end{vmatrix}$$

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12. Find the value of k if the area of a triangle with vertices (k,4),(2,-6) and (5,4) is 35 square unit.

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13. If $\begin{bmatrix} 2 & 5 \\ -3 & 7 \end{bmatrix} \times A = \begin{bmatrix} 17 & -1 \\ 47 & -13 \end{bmatrix}$ then

Find the 2x2 matrix A.

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14. If $\begin{bmatrix} 2 & 5 \\ -3 & 7 \end{bmatrix} \times A = \begin{bmatrix} 17 & -1 \\ 47 & -13 \end{bmatrix}$ then

Find A^2.

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15. Using properties of determinants show

that

$$\begin{vmatrix} 1+a & 1 & 1 \\ 1 & 1+b & 1 \\ 1 & 1 & 1+c \end{vmatrix} = abc\left(1+\frac{1}{a}+\frac{1}{b}+\frac{1}{c}\right)$$

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16. Consider the point

$A(-2,\ -3), B(3, 2), C(-1,\ -8)$

Find the area of ΔABC

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17. Consider the point `A(-2,-3),B(3,2),C(-1,-8)

Find third vertex of any other triangle with same area and base AB

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18. If $A = \begin{bmatrix} 2 & -3 \\ 4 & 6 \end{bmatrix}$.Find adj A.

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19. If $A = \begin{bmatrix} 2 & -3 \\ 4 & 6 \end{bmatrix}$. Find A^{-1}.

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20. Given $\Delta = \begin{vmatrix} y+z & x & y \\ z+x & z & x \\ x+y & y & z \end{vmatrix}$ Apply $R_1 \to R_1 + R_2 + R_3$.

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21. Given $\Delta = \begin{vmatrix} y+z & x & y \\ z+x & z & x \\ x+y & y & z \end{vmatrix}$ Take (x+y+z) common from R_1.

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22. Given $\Delta = \begin{vmatrix} y+z & x & y \\ z+x & z & x \\ x+y & y & z \end{vmatrix}$ Perform $C_1 \to C_1 - 2C_3, C_2 \to C_2 - C_3$

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

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24. Let $A = \begin{bmatrix} -1 & 2 & 4 \\ 1 & 1 & 3 \\ 3 & 2 & 3 \end{bmatrix}$ Find |A|.

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25. Let $A = \begin{bmatrix} -1 & 2 & 4 \\ 1 & 1 & 3 \\ 3 & 2 & 3 \end{bmatrix}$ Find Adj A.

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26. Let $A = \begin{bmatrix} -1 & 2 & 4 \\ 1 & 1 & 3 \\ 3 & 2 & 3 \end{bmatrix}$ Verify that A. AdjA=|A|.I

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27. Consider $A = \begin{bmatrix} 4 & 1 \\ 5 & 3 \end{bmatrix}$. Find A^{-1} and A^T

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28. Consider $A = \begin{bmatrix} 4 & 1 \\ 5 & 3 \end{bmatrix}$. Verify $\left(A^T\right)^{-1} = \left(A^{-1}\right)^T$.

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29. Let $A = \begin{bmatrix} 1 & 4 & 0 \\ -1 & 2 & 2 \\ 0 & 0 & 2 \end{bmatrix}$ Is A singular?

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30. Let $A = \begin{bmatrix} 1 & 4 & 0 \\ -1 & 2 & 2 \\ 0 & 0 & 2 \end{bmatrix}$ Find Adj A.

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31. Let $A = \begin{bmatrix} 1 & 4 & 0 \\ -1 & 2 & 2 \\ 0 & 0 & 2 \end{bmatrix}$ Find A^{-1}

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32. Evaluate $\begin{vmatrix} x & y & x+y \\ y & x+y & x \\ x+y & x & y \end{vmatrix}$

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33. Let $A = \begin{bmatrix} 1 & \sin\theta & 1 \\ -\sin\theta & 1 & \sin\theta \\ -1 & -\sin\theta & 1 \end{bmatrix}$, where $0 \leq \theta \leq 2\pi$

Then

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34. Consider the system of equations $x-y+z=3, 2x+y-z=2, -x-2y+2z=1$. Convert this system of equations in the standard form $AX=B$.

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35. Consider the system of equations $x-y+z=3, 2x+y-z=2, -x-2y+2z=1$. Is A invertible?

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36. Given $\Delta = \begin{vmatrix} x & x^2 & 1+px^3 \\ y & y^2 & 1+py^3 \\ z & z^2 & 1+pz^3 \end{vmatrix}$ Express this as sum of two determinants.

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

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38. Ashok purchased 3 pencils, 2 instrument boxes and 1 pen and paid Rs 41. From the same shop, Babu purchased 2 pencils, 1 instrument box and 2 pens and paid Rs 29 while Rajesh purchased 2 pencil, 2 instrument boxes and 2 pens and paid Rs.44. Formulate the problem into a system of linear equations.

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39. Ashok purchased 3 pencils, 2 instrument boxes and 1 pen and paid Rs 41. From the same

shop, Babu purchased 2 pencils, 1 instrument box and 2 pens and paid Rs 29 while Rajesh purchased 2 pencil, 2 instrument boxes and 2 pens and paid Rs.44. Find the cost of 1 pencil, 1 instrument box and 1 pen.

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40. If $A = \begin{bmatrix} 1 & 2 & -3 \\ 2 & 3 & 2 \\ 3 & -3 & -4 \end{bmatrix}$ Is A non-singular? Why?

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

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42. If $A = \begin{bmatrix} 1 & 2 & -3 \\ 2 & 3 & 2 \\ 3 & -3 & -4 \end{bmatrix}$ Solve the system of linear equations x+2y-3z=-4, 2x+3y+2z=2, 3x-3y-4z=11

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43. If $A^{-1} = \begin{bmatrix} 3 & -1 & 1 \\ -15 & 6 & -5 \\ 5 & -2 & 2 \end{bmatrix}$ and $B = \begin{bmatrix} 1 & 2 & -2 \\ -1 & 3 & 0 \\ 0 & -2 & 1 \end{bmatrix}$ find $(AB)^{-1}$

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44. If $\begin{vmatrix} 1 & -3 & 2 \\ 4 & -1 & 2 \\ 3 & 5 & 2 \end{vmatrix} = 40$, then $\begin{vmatrix} 1 & 4 & 3 \\ -3 & -1 & 5 \\ 2 & 2 & 2 \end{vmatrix} =$

A. 0

B. -40

C. 40

D. 2

Answer:

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45. Show that

$$\Delta = \begin{vmatrix} -a^2 & ab & ac \\ ba & -b^2 & bc \\ ac & bc & -c^2 \end{vmatrix} = 4a^2b^2c^2$$

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46. Let the value of a determinant is Δ.

Then the value of a determinant obtained by interchanging two rows is

A. Δ

B. $-\Delta$

C. 0

D. 1

Answer:

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47. Show that

$$\begin{vmatrix} a+b & b+c & c+a \\ b+c & c+a & a+b \\ c+a & a+b & b+c \end{vmatrix} = 2\begin{vmatrix} a & b & c \\ b & c & a \\ c & a & b \end{vmatrix}$$

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48. The value of the determinant $\begin{vmatrix} \sin 10 & -\cos 10 \\ \sin 50 & \cos 50 \end{vmatrix}$ is a)-1 b) $\frac{\sqrt{3}}{2}$ c) $\frac{1}{2}$ d)-2

A. -1

B. $\frac{\sqrt{3}}{2}$

C. $\frac{1}{2}$

D. -2

Answer:

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49. Using properties of determinants,

show that

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

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50. Choose the correct answer from the bracket.The value of the determinant

$$\begin{vmatrix} 0 & p-q & p-r \\ q-p & 0 & q-r \\ r-p & r-q & 0 \end{vmatrix}$$ is

A. p+q+r

B. 1

C. 0

D. 3pqr

Answer:

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51. Consider $\begin{vmatrix} a & a+b & a+b+c \\ 2a & 3a+2b & 4a+3b+2c \\ 3a & 6a+3b & 10a+6b+3c \end{vmatrix}$

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52. Choose the correct answer from the bracket.Consider a sqare matrix of order 3.Let C_{11}, C_{12}, C_{13} are cofactors of the elements a_{11}, a_{12}, a_{13} respectively,then $a_{11}C_{11} + a_{12}C_{12} + a_{13}C_{13}$ is

A. 0

B. $|A|$

C. 1

D. none of these

Answer:

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53. Verify $A(adjA) = (adjA)A = |A|I$ for the matrix $A = \begin{bmatrix} 5 & -2 \\ 3 & -2 \end{bmatrix}$ that,where $I = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$

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54. Choose the correct answer from the bracket.

If $A = \begin{bmatrix} \cos x & \sin x \\ -\sin x & \cos x \end{bmatrix}$ and $A(adjA) = k\begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$, then the value of k is a)0 b)3 c)1 d)2

A. 0

B. 3

C. 1

D. 2

Answer:

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55. Find the inverse of the following

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

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56. If $A = \begin{bmatrix} 2 & 3 \\ 1 & -2 \end{bmatrix}$ and $A^{-1} = kA$,then the value of 'k' is

A. 7

B. -7

C. $\frac{1}{7}$

D. $-\frac{1}{7}$

Answer:

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57. If $A = \begin{bmatrix} 1 & -1 & 1 \\ 2 & -1 & 0 \\ 1 & 0 & 0 \end{bmatrix}$,

Find A^2

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58. If $A = \begin{bmatrix} 1 & -1 & 1 \\ 2 & -1 & 0 \\ 1 & 0 & 0 \end{bmatrix}$,

Show that $A^2 = A^{-1}$

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59. Choose the correct answer. If each element of a third order square matrix 'A' is multiplied by 3, then the determinant of the newly formed matrix is

a) 9|A| b) 3|A| c) 27|A| d) $(|A|)^3$

A. 9|A|

B. $3|A|$

C. $27|A|$

D. $(|A|)^3$

Answer:

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60. Consider the matrix $A = \begin{bmatrix} -8 & 5 \\ 2 & 4 \end{bmatrix}$ Show that 'A' satisfies the equation $x^2 + 4x - 42 = 0$

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61. Consider the matrix $A = \begin{bmatrix} -8 & 5 \\ 2 & 4 \end{bmatrix}$ Hence find A^{-1}.

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62. If A and B are matrices of order 3 such that $|A| = -1, |B| = 3$, then $|3AB|$ is

A. -9

B. -27

C. -81

D. 9

Answer:

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63. If $A = \begin{bmatrix} 1 & \tan x \\ -\tan x & 1 \end{bmatrix}$, Show that, $A^T A^{-1} = \begin{bmatrix} \cos 2x & -\sin 2x \\ \sin 2x & \cos 2x \end{bmatrix}$.

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64. If $A = \begin{bmatrix} 1 & 1 & 5 \\ 0 & 1 & 3 \\ 0 & -1 & -2 \end{bmatrix}$

what is the value of $|3A|$?

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65. Find the equation of the line joining the points(1,2) and (-3,-2) using determinants.

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66. Find the values of x in which

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

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67. Using the property of determinants,show that the points $A(a, b+c), B(b, c+a), C(c, a+b)$ are collinear.

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68. Examine the consistency of system of following equations:

$5x - 6y + 4z = 15$

$7x + y - 3z = 19$

$2x + y + 6z = 46$

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69. If $A = \begin{bmatrix} 3 & -2 & 3 \\ 2 & 1 & -1 \\ 4 & -3 & 2 \end{bmatrix}$

Find $|A|$

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70. If $A = \begin{bmatrix} 3 & -2 & 3 \\ 2 & 1 & -1 \\ 4 & -3 & 2 \end{bmatrix}$

Find A^{-1}

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71. If $A = \begin{bmatrix} 3 & -2 & 3 \\ 2 & 1 & -1 \\ 4 & -3 & 2 \end{bmatrix}$

Solve the linear equations

$3x - 2y + 3z = 8$

$2x + y - z = 1$

$4x - 3y + 2z = 4$

72. Arjun' purchased 3 pens,2 purses and 1 instrument box and pays Rs. 410. From the same shop 'Deeraj' purchases 2 pens,1 purse and 2

instrument boxes and pays Rs.290, while 'Sindhu' purchases 2pens,2 purses,2 instrument boxes and pays Rs. 440. Translate the equation into system of linear equations.

73. Arjun' purchased 3 pens,2 purses and 1 instrument box and pays Rs. 410.From the same shop 'Deeraj' purchases 2 pens,1 purse and 2 instrument boxes and pays Rs.290,while 'Sindhu' purchases 2pens,2 purses,2 instrument boxes and pays Rs.

440.

The cost of one pen,one purse and one

instrument box using matrix method.

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74. Write the value of $x+y+z$, if

$$\begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} 1 \\ -1 \\ 0 \end{bmatrix}$$

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75. Using properties of determinants prove the following.

$$\begin{vmatrix} b+c & a & a \\ b & c+a & b \\ c & c & a+b \end{vmatrix} = 4abc$$

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76. Consider the points (b,c+a),(c,a+b) and (a,b+c). Find the area of the triangle formed by these points.

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77. Consider the points (b,c+a),(c,a+b) and (a,b+c).

Are the given points collinear? Why?

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78. If $\Delta = \begin{bmatrix} a-b-c & 2a & 2a \\ 2b & b-c-a & 2b \\ 2c & 2c & c-a-b \end{bmatrix}$

Perform $R_1 \to R_1 + R_2 + R_3$ on Δ

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79. If $\Delta = \begin{bmatrix} a-b-c & 2a & 2a \\ 2b & b-c-a & 2b \\ 2c & 2c & c-a-b \end{bmatrix}$

Perform $R_1 \to R_1 + R_2 + R_3$ on Δ. Take (a+b+c) common from R_1 & rewrite Δ.

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80. Using properties of determinants prove the following.

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

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81. Given $\Delta = \begin{bmatrix} a+b & b+c & c+a \\ b+c & c+a & a+b \\ c+a & a+b & b+c \end{bmatrix}$ Express given determinant as the sum of 8 determinants.

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82. Show that $\begin{vmatrix} a+b & b+c & c+a \\ b+c & c+a & a+b \\ c+a & a+b & b+c \end{vmatrix} = 2\begin{vmatrix} a & b & c \\ b & c & a \\ c & a & b \end{vmatrix}$

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83. Find the equation of line joining (1,2) and (3,6) using determinants.

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84. Prove that $\begin{vmatrix} x & \sin\theta & \cos\theta \\ -\sin\theta & -x & 1 \\ \cos\theta & 1 & x \end{vmatrix}$ is independent of θ

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85. Prove that $\begin{vmatrix} x & \sin\theta & \cos\theta \\ -\sin\theta & -x & 1 \\ \cos\theta & 1 & x \end{vmatrix}$ is independent of θ

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86. using properties of determinants, prove that

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

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87. If $A = \begin{bmatrix} 2 & -3 & 5 \\ 3 & 2 & -4 \\ 1 & 1 & -2 \end{bmatrix}$

Find A^{-1}

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88. If $A = \begin{bmatrix} 2 & -3 & 5 \\ 3 & 2 & -4 \\ 1 & 1 & -2 \end{bmatrix}$

Using it solve the system of equations

$2x - 3y + 5z = 16$

$3x + 2y - 4z = -4$

$x + y - 2z = -3$

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89. prove that $\begin{vmatrix} a & b & c \\ a+2x & b+2y & c+2z \\ x & y & z \end{vmatrix} = 0$

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90. if $A = \begin{bmatrix} 1 & -1 & 2 \\ 0 & 2 & -3 \\ 3 & -2 & 4 \end{bmatrix}$ $B = \begin{bmatrix} -2 & 0 & 1 \\ 9 & 2 & -3 \\ 6 & 1 & -2 \end{bmatrix}$

Prove that $B = A^{-1}$

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91. if

$$A = \begin{bmatrix} 1 & -1 & 2 \\ 0 & 2 & -3 \\ 3 & -2 & 4 \end{bmatrix} \quad B = \begin{bmatrix} -2 & 0 & 1 \\ 9 & 2 & -3 \\ 6 & 1 & -2 \end{bmatrix}$$

Using

A^{-1} solve the system of linear equation given

below: x-y+2z=1, 2y-3z=1, 3x-2y+4z=2

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92. If $A = \begin{bmatrix} a & 1 \\ 1 & 0 \end{bmatrix}$ is such that $A^2 = I$ then a

equals

A. 1

B. -1

C. 0

D. 2

Answer:

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93. Solve the system of equations

$x - y + z = 4, 2x + y - 3z = 0, x + y + z = 2$

Using matrix method

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94. The value of $\begin{vmatrix} x & x-1 \\ x+1 & x \end{vmatrix}$ is a)1 b)x c)x^2 d)0

A. 1

B. x

C. x^2

D. 0

Answer:

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95. Using properties of determinants prove the following.

$$\begin{vmatrix} 1 & x & x^2 \\ x^2 & 1 & x \\ x & x^2 & 1 \end{vmatrix} = \left(1 - x^3\right)^2$$

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96. Prove that

$$\begin{vmatrix} 1 & x & x^3 \\ 1 & y & y^3 \\ 1 & z & z^3 \end{vmatrix} = (x + y + z)(x - y)(y - z)(z - y)$$

.

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97. Prove that $\begin{vmatrix} 1! & 2! & 3! \\ 2! & 3! & 4! \\ 3! & 4! & 5! \end{vmatrix} = 4!$

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98. Solve the system of Linear equations

$x + 2y + z = 8, 2x + y - z = 1, x - y + z = 2$

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99. Inverse of the matrix $\begin{bmatrix} 0 & 1 & 2 \\ 0 & 1 & 1 \\ 1 & 0 & 2 \end{bmatrix}$

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100. Find the values of x in which

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

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101. Using the property of determinants,show that the points $A(a, b+c), B(b, c+a), C(c, a+b)$ are collinear.

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102. Examine the consistency of system of following equations:

$5x - 6y + 4z = 15$

$7x + y - 3z = 19$

$2x + y + 6z = 46$

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103. Let B is a square matrix of order 5, then $|kB|$ is equal to....

A. $|B|$

B. $K|B|$

C. $K^5|B|$

D. $5|B|$

Answer:

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104. Prove that

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

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105. Check the consistency of the following equations,

$2x + 3y + z = 6, x + 2y - z = 2,$

$7x + y + 2z = 10$

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106. If $\begin{vmatrix} x & 3 \\ 5 & 2 \end{vmatrix} = 5$,then x=.....

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107. By using properties of determinants, prove that

$$\begin{vmatrix} y+k & y & y \\ y & y+k & y \\ y & y & y+k \end{vmatrix} = k^2(3y+k)$$

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108. Solve the following system of linear Equations,using matrix method,

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

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109. Find 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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110. Find the values of x, if $\begin{vmatrix} 2 & 3 \\ 4 & 5 \end{vmatrix} = \begin{vmatrix} x & 3 \\ 2x & 5 \end{vmatrix}$

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111. Using properties of determinants prove the following.

$$\begin{vmatrix} 1 & x & x^2 \\ x^2 & 1 & x \\ x & x^2 & 1 \end{vmatrix} = \left(1 - x^3\right)^2$$

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112. Find the adjoint of B= $\begin{bmatrix} 1 & -1 & 2 \\ 2 & 3 & 5 \\ -2 & 0 & 1 \end{bmatrix}$

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113. By using properties of determinants, prove that

$$\begin{vmatrix} x+4 & 2x & 2x \\ 2x & x+4 & 2x \\ 2x & 2x & x+4 \end{vmatrix} = (5x+4)(4-x)^2$$

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114. Prove that

$$\begin{vmatrix} y+k & y & y \\ y & y+k & y \\ y & y & y+k \end{vmatrix} = k^2(3y+k)$$

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

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116. Prove that

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

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