MATHS

BOOKS - RD SHARMA MATHS (ENGLISH)

DETERMINANTS

Others

1. If $f(x) = ax^2 + bx + c$ is a quadratic function such that $f(1) = 8, f(2) = 11$ and $f(-3) = 6$ find $f(x)$ by using determinants. Also, find $f(0)$.

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2. The sum of three numbers is 6. If we multiply the third number 2 and add the first number to the result, we get 7. Be adding second and third numbers to three times the first number we get 12. Use determinants to find the numbers.

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3. For what values of a and b , the following system of equations is consistent?

$x+y+z=6$

$2x+5y+az=b$

$x+2y+3z=14$

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4. Determine the values of λ for which the following system of equations : $\lambda x+3y-z=1,\ x+2y+z=2,\ -\lambda x+y+2z=-1$ has non-trival solutions.

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5. Using determinants, show that the following system of linear equation is inconsistent: $x - 3y + 5z = 4$ $2x - 6y + 10z = 11$ $3x - 9y + 15z = 12$

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6. By using determinants, solve the following system of equations: $x + y + z = 1, x + 2y + 3z = 4, x + 3y + 5z = 7.$

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7. Solve the following system of equations by using determinants: $x + y + z = 1, ax + by + cz = k, a^2x + b^2y + c^2z = k^2.$

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8. Using Cramers rule, solve the following system of linear equations: $(a + b)x - (a - b)y = 4ab, (a - b)x + (a + b)y = 2(a^2 - b^2)$

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9. If $\begin{vmatrix} a & p & x \\ b & q & y \\ c & r & z \end{vmatrix} = 16,$ then the value of $\begin{vmatrix} p+x & a+x & a+p \\ q+y & b+y & b+q \\ r+z & c+z & c+r \end{vmatrix}$ is (a) 4

(b) 8 (c) 16 (d) 32

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10. The value of $\left|111^nC_1^{n+2}C_1^{n+4}C_1^nC_2^{n+2}C_2^{n+4}C_2\right|$ is

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11. Solve the following system of homogeneous equations: $x + y - z = 0$

$x - 2y + z = 0$ $3x + 6y - 5z = 0$

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12. For what values of $a and b$, the system of equations $2x+ay+6z=8$ $x+2y+bz=5$ $x+y+3z=4$ has: (i) a unique solution (ii) infinitely many solutions no solution

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13. If x, y, z are different from zero and $\begin{vmatrix} 1+x & 1 & 1 \\ 1 & 1+y & 1 \\ 1 & 1 & 1+z \end{vmatrix}=0$ then the value of $x^{-1}+y^{-1}+z^{-1}$ is (a) xyz (b) $x^{-1}y^{-1}z^{-1}$ (c) $-x-y-z$ (d) -1

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14. Evaluate the following determinants: $|x-7x5x+1|$ (ii) $|\cos\theta-\sin\theta\sin\theta\cos\theta|$ $|\cos 15^0 \sin 15^0 \sin 75^0 \cos 75^0|$ (iv) $|a+ibc+id-c+ida-ib|$

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15. If [] denotes the greatest integer less than or equal to the real number under consideration and $-1 \leq x < 0, 0 \leq y < 1, 1 \leq z < 2,$ the value of the determinant $\begin{vmatrix} [x]+1 & [y] & [z] \\ [x] & [y]+1 & [z] \\ [x] & [y] & [z]+1 \end{vmatrix}$ is

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16. Let $\begin{vmatrix} 3 & y \\ x & 1 \end{vmatrix}$=$\begin{vmatrix} 3 & 2 \\ 4 & 1 \end{vmatrix}$. Find possible values of x and y are natural numbers.

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

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

A. (a) $Det(A) = 0$

B. (b) $Det(A) \in (2, \infty)$

C. (c) $Det(A) \in (2, 4)$

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

Answer: null

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19. Find the minors and cofactors of elements of the matrix

$$A = [a_{ij}] = \begin{bmatrix} 1 & 3 & -2 \\ 4 & -5 & 6 \\ 3 & 5 & 2 \end{bmatrix}$$

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20. Evaluate $= \begin{vmatrix} -1 & 6 & -2 \\ 2 & 1 & 1 \\ 4 & 1 & -3 \end{vmatrix}$ by two methods

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21. If $A = [1321]$, find the determinant of the matrix $A^2 - 2A$.

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22. Determine the values of x for which the matrix A= $\begin{bmatrix} x+1 & -3 & 4 \\ -5 & x+2 & 2 \\ 4 & 1 & x-6 \end{bmatrix}$ is singular.

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23. The value of the determinant $\begin{vmatrix} x & x+y & x+2y \\ x+2y & x & x+y \\ x+y & x+2y & x \end{vmatrix}$ is (a) $9x^2(x+y)$ (b) $9y^2(x+y)$ (c) $3y^2(x+y)$ (d) $7x^2(x+y)$

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24. The number of distinct real roots of $\begin{vmatrix} \cos ecx & \sec x & \sec x \\ \sec x & \cos ecx & \sec x \\ \sec x & \sec x & \cos ecx \end{vmatrix} = 0$ lies in the interval $-\frac{\pi}{4} \leq x \leq \frac{\pi}{4}$ is 1 (b) 2 (c) 3 (d) 0

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25. Let $f(x) = \begin{vmatrix} \cos x & x & x \\ 2\sin x & x & 2x \\ \sin x & x & x \end{vmatrix}$, then $\lim_{x \to 0} \frac{f(x)}{x^2}$ is equal to (a)0(b) -1 (c) 2 (d) 3

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26. A triangle has its three sides equal to a, b and c. If the coordinates of its vertices are $A(x_1, y_1), B(x_2, y_2)$ and $C(x_3, y_3)$, show that

$$\begin{vmatrix} x_1 & y_1 & 2 \\ x_2 & y_2 & 2 \\ x_3 & y_3 & 2 \end{vmatrix}^2 = (a+b+c)(b+c-a)(c+a-b)(a+b-c)$$

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27. Solve the following system of equations using Cramers rule.

$5x - 7y + z = 11, 6x - 8y - z = 15$ and $3x + 2y - 6z = 7$

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28. Let $A = \begin{vmatrix} 1 & \sin\theta & 1 \\ -\sin\theta & 1 & \sin\theta \\ -1 & -\sin\theta & 1 \end{vmatrix}$, where $0 \le \theta \le 2\pi$. 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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29. Prove the identities: $\begin{vmatrix} a & b-c & c-b \\ a-c & b & c-a \\ a-b & b-a & c \end{vmatrix}$

$= (a+b-c)(b+c-a)(c+a-b)$

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30. Prove the identity: $\begin{vmatrix} b^2+c^2 & ab & ac \\ ba & c^2+a^2 & bc \\ ca & cb & a^2+b^2 \end{vmatrix} = 4a^2b^2c^2$

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31. $\begin{vmatrix} \frac{a^2+b^2}{c} & c & c \\ a & \frac{b^2+c^2}{a} & a \\ b & b & \frac{a^2+c^2}{b} \end{vmatrix}$ equal to : (A) $4abc$ (B) $a^2+b^2+c^2$ (C) $(a+b+c)^2$ (D) None of These

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32. Prove that identities: $\begin{vmatrix} -bc & b^2+bc & c^2+bc \\ a^2+ac & -ac & c^2+ac \\ a^2+ab & b^2+ab & -ab \end{vmatrix} = (ab+bc+ac)^3$

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33. Without expanding, prove that $|abcxyzpqr| = |xyzpqrabc| = |ybqxapzcr|$

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34. If $\begin{vmatrix} p & b & c \\ a & q & c \\ a & b & r \end{vmatrix} = 0,$ find the value of $\frac{p}{p-a} + \frac{q}{q-b} + \frac{r}{r-c}, p \neq a, q \neq b, r \neq c.$

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35. Find the equation of the line joining $A(1, 3) and B(0, 0)$ using determinants and find k if $D(k, 0)$ is appoint such that area of ABD is 3sq. units.

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36. If $A(x_1, y_1), B(x_2, y_2)$ and $C(x_3, y_3)$ are vertices of an equilateral triangle whose each side is equal to a , then prove that

$$\begin{vmatrix} x_1 & y_1 & 2 \\ x_2 & y_2 & 2 \\ x_3 & y_3 & 2 \end{vmatrix}^2 = 3a^4$$

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37. If $f(x) = |0x - ax - bx + a0x - cx + bx + c0|, then\ f(x) = 0$ (b) $f(b) = 0$ (c) $f(0) = 0$ $f(1) = 0$

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38. Prove the identities:

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

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39. Prove the identities: $\begin{vmatrix} z & x & y \\ z^2 & x^2 & y^2 \\ z^4 & x^4 & y^4 \end{vmatrix} = \begin{vmatrix} x & y & z \\ x^2 & y^2 & z^2 \\ x^4 & y^4 & z^4 \end{vmatrix} = \begin{vmatrix} x^2 & y^2 & z^2 \\ x^4 & y^4 & z^4 \\ x & y & z \end{vmatrix}$

=x y z (x-y)(y-z)(z-x)(x+y+z)

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40. Without expanding, show that the value of each of the determinants is zero: $|\sin\alpha\cos\alpha\cos(\alpha+\delta)\sin\beta\cos\beta\cos(\beta+\delta)\sin\gamma\cos\gamma\cos(\gamma+\delta)|$

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41. Without expanding, show that the value of each of the determinants is zero: $\begin{vmatrix} (2^x+2^{-x})^2 & (2^x-2^{-1})^2 & 1 \\ (3^x+3^{-1})^2 & (3^x-3^{-x})^2 & 1 \\ (4^x+4^{-x})^2 & (4^x-4^{-x})^2 & 1 \end{vmatrix}$

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42. Without expanding, show that the value of each of the determinants is zero: $\begin{vmatrix} 1 & a & a^2-bc \\ 1 & b & b^2-ac \\ 1 & c & c^2-ab \end{vmatrix}$

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43. Without expanding, show that the value of each of the determinants is zero: $|a+b2a+b3a+b2a+b3a+b4a+b4a+b5a+b6a+b|$

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44. Using the properties of determinants, prove that following $\begin{vmatrix} a-b-c & 2a & 2a \\ 2b & b-c-a & 2b \\ 2c & 2c & c-a-b \end{vmatrix} = (a+b+c)^3$

A. 1.(a+b+c)

B. null

C. null

D. null

Answer: null

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

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46. For any $\triangle ABC$, the value of determinant $\begin{vmatrix} \sin^2 A & \cot A & 1 \\ \sin^2 B & \cot B & 1 \\ \sin^2 C & \cot C & 1 \end{vmatrix}$ is:

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47. Without expanding, show that the value of each of the determinants is zero:

$|\cos(x+y) - \sin(x+y) \cos 2y \sin x \cos x \sin y - \cos x \sin x \ - \cos y|$

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48. If $x, y \in R,$ then the determinant = $\begin{vmatrix} \cos x & -\sin x & 1 \\ \sin x & \cos x & 1 \\ \cos(x+y) & -\sin(x+y) & 0 \end{vmatrix}$ lies in the interval (a) $\left[-\sqrt{2}, \sqrt{2}\right]$ (b) $[-1, 1]$ (c) $\left[-\sqrt{2}, 1\right]$ (d) $\left[-1, -\sqrt{2}\right]$

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49. The maximum value of $\Delta = \begin{vmatrix} 1 & 1 & 1 \\ 1 & 1+\sin\theta & 1 \\ 1+\cos\theta & 1 & 1 \end{vmatrix}$ is (θ is real) (A) $\frac{1}{2}$ (B) $\frac{\sqrt{3}}{2}$ (C) $\sqrt{2}$ (D) $-\frac{\sqrt{3}}{2}$

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50. Prove that: $\begin{vmatrix} -2a & a+b & a+c \\ b+a & -2b & b+c \\ c+a & c+b & -2c \end{vmatrix} = 4(a+b)(b+c)(c+a)$

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51. Without expanding, show that the value of each of the determinants is zero: $\left|\frac{1}{a}a^2bc\frac{1}{b}b^2ac\frac{1}{c}c^2ab\right|$

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52. If m is a positive integer and $D_r = \left|2r - 1\ {}^mC_r 1m^2 - 12^m m + 1s \in^2 \left(m^2\right)s \in^2 (m)s \in^2 (m+1)\right|$.

Prove that $\sum_{r=0}^{m} D_r = 0$.

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53. Without expanding, show that

$\text{Delta} = \left|(a-x)^2(a-y)^2(a-z)^2(b-x)^2(b-y)^2(b-z)^2(c-x)^2(c-y\right.$

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54. Let $\Delta_r = \begin{vmatrix} r & x & \frac{n(n+1)}{2} \\ 2r-1 & y & n^2 \\ 3r-2 & z & \frac{n(3n-1)}{2} \end{vmatrix}$. Show that $\sum_{r=1}^{n} \Delta_r = 0$

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55. If $\Delta_r = \begin{vmatrix} 2^{r-1} & 2.3^{r-1} & 4.\,5^{r-1} \\ x & y & z \\ 2^n-1 & 3^n-1 & 5^n-1 \end{vmatrix}$. Show that $\sum_{r=1}^{n} \Delta_r = Constant$

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56. Find a quadratic polynomial $\phi(x)$ whose zeros are the maximum and minimum values of the function:

$$f(x) = \begin{vmatrix} 1+\sin^2 x & \cos^2 x & \sin 2x \\ \sin^2 x & 1+\cos^2 x & \sin 2x \\ \sin^2 x & \cos^2 x & 1+\sin 2x \end{vmatrix}$$

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57. Let $f(x)=\begin{vmatrix} \sec x & \cos x & \sec^2 x+\cot x \cos ecx \\ \cos^2 x & \cos^2 x & \cos ec^2 x \\ 1 & \cos^2 x & \cos^2 x \end{vmatrix}$ Prove that $\int_0^{\frac{\pi}{2}} f(x)dx = -\frac{\pi}{4}-\frac{8}{15}$

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58. Show that: $\begin{vmatrix} a & b-c & c+b \\ a+c & b & c-a \\ a-b & b+a & c \end{vmatrix} = (a+b+c)\left(a^2+b^2+c^2\right)$.

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59. If a, b, c are real numbers, prove that $\begin{vmatrix} a & b & c \\ b & c & a \\ c & a & b \end{vmatrix} = -(a+b+c)\left(c+bw+cw^2\right)\left(a+bw^2+cw\right)$, where w is a complex cube root of unity.

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60. Solve: $\left|a + xa - xa - xa - xa + xa - xa - xa - xa + x\right| = 0$

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61. Show that:

$$\begin{vmatrix} 3a & -a+b & -a+c \\ -b+a & 3b & -b+c \\ -c+a & -c+b & 3c \end{vmatrix} = 3(a+b+c)(ab+bc+ca).$$

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62. If a,b,c are all distinct and $\begin{vmatrix} a & a^3 & a^4-1 \\ b & b^3 & b^4-1 \\ c & c^3 & c^4-1 \end{vmatrix}$ =0, show that abc(ab+bc+ac) = a+b+c

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

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64. If $x+y+z=0$, prove that $\begin{vmatrix} xa & yb & zc \\ yc & za & xb \\ zb & xc & ya \end{vmatrix} = xyz\begin{vmatrix} a & b & c \\ c & a & b \\ b & c & c \end{vmatrix}$

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65. If a , b , c are all positive and are pth ,qth and rth terms of a G.P., then show that $= \begin{vmatrix} \log a & p & 1 \\ \log b & q & 1 \\ \log c & r & 1 \end{vmatrix} = 0$

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66. Prove that: $\begin{vmatrix} bc-a^2 & ca-b^2 & ab-c^2 \\ ca-b^2 & ab-c^2 & bc-a^2 \\ ab-c^2 & bc-a^2 & ca-b^2 \end{vmatrix}$ is divisible by $a+b+c$ and find the quotient.

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67. $\begin{vmatrix} bc-a^2 & ca-b^2 & ab-c^2 \\ ca-b^2 & ab-c^2 & bc-a^2 \\ ab-c^2 & bc-a^2 & ca-b^2 \end{vmatrix} = \begin{vmatrix} a & b & c \\ b & c & a \\ c & a & b \end{vmatrix}^2$

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68. Prove that: $\begin{vmatrix} (b+c)^2 & a^2 & a^2 \\ b^2 & (c+a)^2 & b^2 \\ c^2 & c^2 & (a+b)^2 \end{vmatrix} = 2abc(a+b+c)^3$

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69. Show that $\begin{vmatrix} b^2+c^2 & ab & ac \\ ba & c^2+a^2 & bc \\ ca & cb & a^2+b^2 \end{vmatrix} = 4a^2b^2c^2$

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70. Prove that:

$$\begin{vmatrix} a & b & ax+by \\ b & c & bx+cy \\ ax+by & bx+cy & 0 \end{vmatrix} = \left(b^2-ac\right)\left(ax^2+2bxy+cy^2\right)$$

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71. Without expanding the determinant, show that $(a+b+c)$ is a factor of the determinant $\begin{vmatrix} a & b & c \\ b & c & a \\ c & a & b \end{vmatrix}$

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72. If $m \in N$ and $m \geq 2,$ prove that:

$|111m_{C_1}m+1_{C_1}m+2_{C_1}m_{C_2}m+1_{C_2}m+2_{C_2}|=1$

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73. Evaluate: = $\begin{vmatrix} 10! & 11! & 12! \\ 11! & 12! & 13! \\ 12! & 13! & 14! \end{vmatrix}$

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74. Show that:

$|b + cc + aa + bq + rr + pp + qy + zz + xx + y| = 2|abcpqrxyz|$

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75. Prove that

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

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76. If $a, b, c,$ are roots of the equation $x^3 + px + q = 0,$ prove that

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

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77. If $a + b + c \neq 0$ and $|abcbcacab| = 0$, then prove that $a = b = \cdot$

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78. Let $a, b$and c detnote the sides BC, CAandAB respectively of triangleABC. If $\begin{vmatrix} 1 & a & b \\ 1 & c & a \\ 1 & b & c \end{vmatrix} = 0.$ find the value of $\sin^2 A + \sin^2 B + \sin^2 C$

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79. Prove that $\begin{vmatrix} a^2+2a & 2a+1 & 1 \\ 2a+1 & a+2 & 1 \\ 3 & 3 & 1 \end{vmatrix} = (a-1)^3$

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80. Using properties of determinant show that: $\begin{vmatrix} 1 & a & bc \\ 1 & b & ca \\ 1 & c & ab \end{vmatrix} = (a-b)(b-c)(c-a)$

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81. Using properties of determinants, show that triangle ABC is isosceles, if : |(1,1,1),(1+cosA, 1+cosB, 1+cosC),(sqrecosA+cosA, cossqrB+cosB, cossqurC+cosC)| =0

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82. In a $\triangle ABC$, if $\left|[1, 1, 1][1+\sin A, 1+\sin B, 1+\sin C], \left[\sin A+\sin^2 A, \sin B+\sin^2 B, \text{si}\right.\right.$

, then prove that $\triangle ABC$ is an isosceles triangle.

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83. Show that : $\begin{vmatrix} x & y & z \\ x^2 & y^2 & z^2 \\ x^3 & y^3 & z^3 \end{vmatrix} = xyz(x-y)(y-z)(z-x).$

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84. Without expanding or evaluating show that

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

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85. If A is a skew-symmetric matrix of odd order n, then $|A| = 0$

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86. Using properties of determinants, show that

$$\begin{vmatrix} x & p & q \\ p & x & q \\ q & q & x \end{vmatrix} = (x-p)\left(x^2 + px - 2q^2\right)$$

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87. If $f(x) = \begin{vmatrix} a & -1 & 0 \\ ax & a & -1 \\ ax^2 & ax & a \end{vmatrix}$, using properties of determinants, find the value of $f(2x) - f(x)$.

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88. If a, b, c are distinct real numbers and the system of equations $ax + a^2y + (a^3 + 1)z = 0$ $bx + b^2y + (b^3 + 1)z = 0$ $cx + c^2y + (c^3 + 1) = 0$ has a non-trivial solution, show that $abc = -1$

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89. If x, y, z are not all zero such that $ax + y + z = 0$, $x + by + z = 0$, $x + y + cz = 0$ then prove that $\frac{1}{1-a} + \frac{1}{1-b} + \frac{1}{1-c} = 1$

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90. Find the value of λ for which the homogeneous system of equations: $2x + 3y - 2z = 0 \;\; 2x - y + 3z = 0 \;\; 7x + \lambda y - z = 0$ has non-trivial solutions. Find the solution.

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91. If the system of equations $x = cy + bz \; y = az + cx \; z = bx + ay$ has a non-trivial solution, show that $a^2 + b^2 + c^2 + 2abc = 1$

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92. A matrix A of order $3x3$ has determinant 5. What is the value of $|3A|$?

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93. If A is a square matrix such that $|A| = 2$, write the value of $\left|\forall^T\right|$

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94. Find the real values of λ for which the following system of linear equations has non-trivial solutions. Also, find the non-trivial solutions. $2\lambda x - 2y + 3z = 0 \; x + \lambda y + 2z = 0 \; 2x + \lambda z = 0$

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95. If a, b, c are non-zero real numbers and if the system of equations $(a-1)x = y + z \; (b-1)y = z + x \; (c-1)z = x + y$ has a non-trivial solution, then $ab + bc + ca$ equals to (A) abc (B) $a^2 - b^2 + c^2$ (C) $a + b - c$ (D) None of these

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96. Which of the following is not correct in a given determinant of A, where $A = \left(\left[a_{ij}\right]\right)_{3x3}$

A. Order of minor is less than order of the det(A)

B. Minor of an element can never be equal to cofactor of the same element

C. Value of a determinant is obtained by multiplying elements of a row or column by corresponding cofactors

D. Order of minors and cofactors of elements of A is same

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97. Let $\left|x2 \times^2 x6 \times 6\right| = ax^4 + bx^3 + cx^2 + dx + e\cdot$ Then, the value of $5a + 4b + 3c + 2d + e$ is equal 0 (b) -16 (c) 16 (d) none of these

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98. Let $\delta = \left|Axx^2 1Byy^2 1Czz^2 1\right| and_1 = |ABCxyzyzz \times y|,$ then show that $\delta = \delta 1$

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99. If $\Delta_1 = \begin{vmatrix} a & b & c \\ x & y & z \\ p & q & r \end{vmatrix}$ and $\Delta_2 = \begin{vmatrix} q & -b & y \\ -p & a & -x \\ r & -c & z \end{vmatrix}$, without expanding or evaluating Δ_1 and Δ_2, show that $\Delta_1 + \Delta_2 = 0$

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100. Without expanding show that: = $\begin{vmatrix} \cos ec^2\theta & \cot^2\theta & 1 \\ \cot^2\theta & \cos ec^2\theta & -1 \\ 42 & 40 & 2 \end{vmatrix}$=0

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101. Find the value of the determinant = $\begin{vmatrix} 2 & 3 & 4 \\ 5 & 6 & 8 \\ 6x & 9x & 12x \end{vmatrix}$

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102. Without expanding evaluate the determinant $\begin{vmatrix} 41 & 1 & 5 \\ 79 & 7 & 9 \\ 29 & 5 & 3 \end{vmatrix}$

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103. Show that $\left|1ab_c1bc+a1ca+b\right|=0$

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104. Without expanding evaluate the determinant $\begin{vmatrix}(a^x+a^{-x})^2 & (a^x-a^{-x})^2 & 1\\(a^y+a^{-y})^2 & (a^y-a^{-y})^2 & 1\\(a^z+a^{-z})^2 & (a^z-a^{-z})^2 & 1\end{vmatrix}$, where $a>0$ and $x, y, z\in R$

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105. If $D_1=\begin{vmatrix}1 & 1 & 1\\x^2 & y^2 & z^2\\x & y & z\end{vmatrix}$ and $D_2=\begin{vmatrix}1 & 1 & 1\\yz & zx & xy\\x & y & z\end{vmatrix}$ without expanding prove that $D_1=D_2$

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106. Without expanding show that $\begin{vmatrix} b^2c^2 & bc & b+c \\ c^2a^2 & ca & c+a \\ a^2b^2 & ab & a+b \end{vmatrix} = 0$

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107. Without expanding evaluate the determinant $\begin{vmatrix} \sin\alpha & \cos\alpha & \sin(\alpha+\delta) \\ \sin\beta & \cos\beta & \sin(\beta+\delta) \\ \sin\gamma & \cos\gamma & \sin(\gamma+\delta) \end{vmatrix}$

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108. If $A+B+C=\pi$, then the value of $\begin{vmatrix} \sin(A+B+C) & \sin(A+C) & \cos C \\ -\sin B & 0 & \tan C \\ \cos(A+B) & \tan(B+C) & 0 \end{vmatrix}$ is equal to (a)0 (b) 1 (c) $2\sin B\tan A\cos C$ (d) none of these

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109. If $A_r = \begin{vmatrix} 1 & r & 2^r \\ 2 & n & n^2 \\ n & \frac{n(n+1)}{2} & 2^{n+1} \end{vmatrix}$, the value of $\sum_{r=1}^{n} A_r$ is (A) n (B) $2n$ (C) $-2n$ (D) n^2

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110. If the determinant $\begin{vmatrix} a & b & 2a\alpha + 3b \\ b & c & 2b\alpha + 3c \\ 2a\alpha + 3b & 2b\alpha + 3c & 0 \end{vmatrix} = 0$ then (a) a, b, c are in H.P. α is root of $4ax^2 + 12bx + 9c = 0$ or a, b, c are in G.P. $a, b, c,$ are in G.P. only a, b, c are in A.P.

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111. If a, b, c are distinct, then the value of x satisfying $\left|0x^2 - ax^3 - bx^2 + a0x^2 + cx^4 + bx - c0\right| = 0is$ c (b) a (c) b (d) 0

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112. Using the factor theorem it is found that a+b , b+c and c+a are three factors of the determinant $\begin{vmatrix} -2a & a+b & a+c \\ b+a & -2b & b+c \\ c+a & c+b & -2c \end{vmatrix}$. The other factor in the value of the determinant is

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113. Let

$\left|x^2 + 3 \times \ - 1x + 3x + 1 - 2 \times \ - 4x - 3x + 43x\right| = ax^4 + bx^3 + cx^2 +$

be an identity in x, where a, b, c, d, e are independent of $x\cdot$ Then the value of e is 4 (b) 0 (c) 1 (d) none of these

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114. If $D_k = \begin{vmatrix} 1 & n & n \\ 2k & n^2+n+2 & n^2+n \\ 2k-1 & n^2 & n^2+n+2 \end{vmatrix}$ and $\sum_{k=1}^{n} D_k = 48$,then n equals (a)4 (b)6 (c)8 (d) none of these

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115. If $\Delta_1 = \begin{vmatrix} 1 & 1 & 1 \\ a & b & c \\ a^2 & b^2 & c^2 \end{vmatrix}, \Delta_2 = \begin{vmatrix} 1 & bc & a \\ 1 & ca & b \\ 1 & ab & c \end{vmatrix}, then$ (a)$\Delta_1 + \Delta_2 = 0$ (b) $\Delta_1 + 2\Delta_2 = 0$ (c)$\Delta_1 = \Delta_2$ (d) none of these

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116. The value of the determinant $\left|a^2 a 1 \cos nx \cos(n+1)x \cos(n+2)x \sin nx \sin(n+1)x \sin(n+2)x\right|$ is independent of n (b) a (c) x (d) none of these

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117. Evaluate: (i) $\begin{vmatrix} 5 & 4 \\ -2 & 3 \end{vmatrix}$ (ii) $\begin{vmatrix} \sin\theta & \cos\theta \\ -\cos\theta & \sin\theta \end{vmatrix}$

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118. Evaluate: (i) $\begin{vmatrix} x^2+xy+y^2 & x+y \\ x^2-xy+y^2 & x-y \end{vmatrix}$

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119. Evaluate D $= \begin{vmatrix} 2 & 3 & -2 \\ 1 & 2 & 3 \\ -2 & 1 & -3 \end{vmatrix}$ by expanding it along the second row.

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120. Evaluate the determinant $D = \begin{vmatrix} 2 & 3 & -2 \\ 1 & 2 & 3 \\ -2 & 1 & -3 \end{vmatrix}$ by expanding it along first row.

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121. Evaluate D $= \begin{vmatrix} 2 & 3 & -2 \\ 1 & 2 & 3 \\ -2 & 1 & -3 \end{vmatrix}$

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122. Evaluate $= \begin{vmatrix} -1 & 6 & -2 \\ 2 & 1 & 1 \\ 4 & 1 & -3 \end{vmatrix}$ by method.

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123. For what value of x the matrix $A = \begin{bmatrix} 1 & -2 & 3 \\ 1 & 2 & 1 \\ x & 2 & -3 \end{bmatrix}$ is singular?

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124. Determine the values of x for which the matrix $A = [x + 1 - 34 - 5x + 2241x - 6]$ is singular.

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125. If $A = [1321]$, find the determinant of the matrix $A^2 - 2A$.

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126. If $A = [1242]$, then show that $|2A| = 4|A|$.

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127. If $\begin{vmatrix} x-2 & -3 \\ 3x & 2x \end{vmatrix} = 3$, find the values of x

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128. Let $\begin{vmatrix} 3 & y \\ x & 1 \end{vmatrix} = \begin{vmatrix} 3 & 2 \\ 4 & 1 \end{vmatrix}$ Find possible values of x and y if x,y are natural numbers

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129. Evaluate the determinant $= \begin{vmatrix} (\log)_3 512 & (\log)_4 3 \\ (\log)_3 8 & (\log)_4 9 \end{vmatrix}$.

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130. Find the minors of cofactors of elements of the matrix
$A = [a_{ij}] = \begin{bmatrix} 1 & 3 & -2 \\ 4 & -5 & 6 \\ 3 & 5 & 2 \end{bmatrix}$

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

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132. If [ ] denotes the greatest integer less than or equal to the real number under consideration, and $-1 \leq x < 0, 0 \leq y < 1, 1 \leq z < 2$, then find the value of the following determinant:
$\begin{vmatrix} [x]+1 & [y] & [z] \\ [x] & [y]+1 & [z] \\ [x] & [y] & [z]+1 \end{vmatrix}$ (A) 0 (B) 1 (C) 2 (D) 3

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

θ

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134. Write the minors and cofactors of each element of the first column of the following matrices and hence evaluate the determinant in each case:

$A = \begin{bmatrix} 5 & 20 \\ 0 & -1 \end{bmatrix}$ (ii) $A = \begin{bmatrix} -1 & 4 \\ 2 & 3 \end{bmatrix}$ (iii) $A = \begin{bmatrix} 1 & -3 & 2 \\ 4 & -1 & 2 \\ 3 & 5 & 2 \end{bmatrix}$ (iv)

$A = \begin{bmatrix} 1 & a & bc \\ 1 & b & ca \\ 1 & c & ab \end{bmatrix}$

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135. Write the minors and cofactors of each element of the first column of the following matrices and hence evaluate the determinant in each case:

$A = \begin{bmatrix} 0 & 2 & 6 \\ 1 & 5 & 0 \\ 3 & 7 & 1 \end{bmatrix}$ (ii) $A = \begin{bmatrix} a & h & g \\ h & b & f \\ g & f & c \end{bmatrix}$ (ii) $A = \begin{bmatrix} 2 & -1 & 0 & -3 \\ 0 & 1 & 1 & 1 \\ -1 & 2 & -1 & 5 \\ 1 & -2 & 1 & 0 \end{bmatrix}$

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136. Evaluate the following determinants: $|x - 7x5x + 1|$ (ii) $|\cos\theta - \sin\theta\sin\theta\cos\theta|$ $|\cos 15^0 \sin 15^0 \sin 75^0 \cos 75^0|$ (iv) $|a + ibc + id - c + ida - ib|$

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137. Evaluate the following determinants: $\begin{vmatrix} x-7 & x \\ 5 & x+1 \end{vmatrix}$ (ii) $\begin{vmatrix} \cos\theta & -\sin\theta \\ \sin\theta & \cos\theta \end{vmatrix}$ $\begin{vmatrix} \cos 15^0, \sin 15^0 \\ \sin 75^0, \cos 75^0 \end{vmatrix}$ (iv) $\begin{vmatrix} a+ib & c+id \\ -c+id & a-ib \end{vmatrix}$

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138. Evaluate: $\begin{vmatrix} 2 & 3 & 7 \\ 13 & 17 & 5 \\ 15 & 20 & 12 \end{vmatrix}^2$.

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139. Show that $\begin{vmatrix} \sin 10 & -\cos 10 \\ \sin 80 & \cos 80 \end{vmatrix} = 1$

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140. Evaluate $\begin{vmatrix} 2 & 3 & -5 \\ 7 & 1 & -2 \\ -3 & 4 & 1 \end{vmatrix}$ by method.

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

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

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143. If $A = \begin{bmatrix} 2 & 5 \\ 2 & 1 \end{bmatrix}$ and $B = \begin{bmatrix} 4 & -3 \\ 2 & 5 \end{bmatrix}$, verify that $|AB| = |A||B|$.

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144. If $A = \begin{bmatrix} 1 & 0 & 1 \\ 0 & 1 & 2 \\ 0 & 0 & 4 \end{bmatrix}$, then show that $|3A| = 27|A|$

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145. Find the values of x , if $\begin{vmatrix} 2 & 4 \\ 5 & 1 \end{vmatrix} = \begin{vmatrix} 2x & 4 \\ 6 & x \end{vmatrix}$

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146. Find the values of x , if $\begin{vmatrix} 3x & 7 \\ 2 & 4 \end{vmatrix} = 10$

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147. Find the integral value of x , if $\begin{vmatrix} x^2 & x & 1 \\ 0 & 2 & 1 \\ 3 & 1 & 4 \end{vmatrix} = 28$.

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148. For what value of x the matrix A is singular? $A = \begin{bmatrix} 1+x & 7 \\ 3-x & 8 \end{bmatrix}$

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149. Without expanding evaluate the determinant $|411579792953|$

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150. If w is a complex cube root of unity. Show that $\begin{vmatrix} 1 & w & w^2 \\ w & w^2 & 1 \\ w^2 & 1 & w \end{vmatrix} = 0$.

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151. Show that $\begin{vmatrix} 1 & a & b+c \\ 1 & b & c+a \\ 1 & c & a+b \end{vmatrix} = 0$.

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152. Show that $\begin{vmatrix} b-c & c-a & a-b \\ c-a & a-b & b-c \\ a-b & b-c & c-a \end{vmatrix}$ = 0 .

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

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154. Without expanding prove that: $\begin{vmatrix} x+y & y+z & z+x \\ z & x & y \\ 1 & 1 & 1 \end{vmatrix} = 0$.

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155. Without expanding show that: $= \begin{vmatrix} \cos ec^2\theta & \cot^2\theta & 1 \\ \cot^2\theta & \cos ec^2\theta & -1 \\ 42 & 40 & 2 \end{vmatrix} = 0$

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156. Find the value of the determinant = $\begin{vmatrix} 2 & 3 & 4 \\ 5 & 6 & 8 \\ 6x & 9x & 12x \end{vmatrix}$.

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157. Without expanding show that

$\left|b^2c^2bcb + \hat{} \ 2a^2cac + aa^2b^2aba + b\right| = 0$.

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158. Without expanding evaluate the determinant

$|\sin\alpha\cos\alpha\sin(\alpha+\delta)\sin\beta\cos\beta\sin(\beta+\delta)\sin\gamma\cos\gamma\sin(\gamma+\delta)|$.

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159. Without expanding evaluate the determinant $\left|\left(a^x+a^{-x}\right)^2\left(a^x-a^{-x}\right)^2 1\left(a^y+a^{-y}\right)^2\left(a^y-a^{-y}\right)^2 1\left(a^2+a^{-z}\right)^2\left(a^z-a^{-}\right.\right.$

where $a, > 0 and x, y, z \in R$.

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160. If a, b, c are in A.P., find the 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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161. Without expanding evaluate the determinant $= \begin{vmatrix} 265 & 240 & 219 \\ 240 & 225 & 198 \\ 219 & 198 & 181 \end{vmatrix}$.

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162. If $D1 = \left|111x^2y^2z^2xyz\right|$ and $D2 = |111yzz \times yxyz|$, without expanding prove that $D1 = D2$.

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163. Let D $= \left|Axx^21Byy^21Czz^21\right|$ and $D1 = |ABCxyzyzzxy|$, then show that $D1 = D$.

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164. If $A = \begin{vmatrix} a & b & c \\ x & y & z \\ p & q & r \end{vmatrix}$ and $B = \begin{vmatrix} q & -b & y \\ -p & a & -x \\ r & -c & z \end{vmatrix}$, without expanding or evaluating A and B , show that $A + B = 0$.

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165. If A is a skew-symmetric matrix of odd order n , then $|A| = O$.

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

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167. Without expanding or evaluating show that $\begin{vmatrix} 0 & b-a & c-a \\ a-b & 0 & c-b \\ a-c & b-c & 0 \end{vmatrix} = 0$.

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168. Without expanding, prove that $\begin{vmatrix} a+bx & c+dx & p+qx \\ ax+b & cx+d & px+q \\ u & v & w \end{vmatrix} = \left(1-x^2\right)\begin{vmatrix} a & c & p \\ b & d & q \\ u & v & w \end{vmatrix}$.

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169. Prove that: $\left| -a^2abacba-b^2bcacbcc^2 \right| = 4a^2b^2c^2$.

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170. Prove that: $\begin{vmatrix} 1 & 1 & 1 \\ 1 & 1+x & 1 \\ 1 & 1 & 1+y \end{vmatrix} = xy$.

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171. Evaluate: $\begin{vmatrix} 1 & a & a^2 \\ 1 & b & b^2 \\ 1 & c & c^2 \end{vmatrix}$.

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172. Show that : $\begin{vmatrix} x & y & z \\ x^2 & y^2 & z^2 \\ x^3 & y^3 & z^3 \end{vmatrix} = xyz(x-y)(y-z)(z-x) \cdot$

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173. Prove that:

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

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174. In a $\triangle ABC$, if

$$\begin{vmatrix} 1 & 1 & 1 \\ 1+\sin A & 1+\sin B & 1+\sin C \\ \sin A+\sin^2 A & \sin B+\sin^2 B & \sin C+\sin^2 C \end{vmatrix} = 0,$$ then prove that $\triangle ABC$ is an isosceles triangle.

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175. In a

ABC, if $|1111+\cos A1+\cos B1+\cos C\cos^2 A+A\cos^2 B+\cos B\cos^2$

show that ABC is an isosceles.

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176. Show that

$$\begin{vmatrix} a & b & c \\ a^2 & b^2 & c^2 \\ bc & ca & ab \end{vmatrix} = \begin{vmatrix} 1 & 1 & 1 \\ a^2 & b^2 & c^2 \\ a^3 & b^3 & c^3 \end{vmatrix} = (a-b)(b-c)(c-a)(ab+bc+ca) .$$

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177. If $x \neq y \neq z$ and $\left|xx^2 1 + x^3 yy^2 1 + y^3 zz^2 1 + z^3\right| = 0$, then prove that $xyz = -1$.

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178. For any scalar p prove that

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

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179. Using properties of determinants, show that $\left|1aa^2 - bc1bb^2 - ca1cc^2 - ab\right| = 0$

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180. Prove that: $\left|a^2 + 2a2a + 112a + 1a + 21331\right| = (a-1)^3$.

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181. Let a, b and c denote the sides BC, CA and AB respectively of ABC. If $|1ab1ca1bc| = 0$, then find the value of $\sin^2 A + \sin^2 B + \sin^2 C$.

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182. If $f(x) = \begin{vmatrix} a-1 & 0 & a \\ x & a-1 & a \\ x^2 a & x & a \end{vmatrix}$, using properties of determinants, find the value of $f(2x) - f(x)$.

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183. Show that: $xpqpxqqq \times \; - p)\left(x^2 + px - 2q^2\right)$.

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184. If $m \in N$ and $m \geq 2$ prove that: $\left|111\ {}^{m}C_1\ {}^{m+1}C_1\ {}^{m+2}C_1\ {}^{m}C_2\ {}^{m+1}C_2\ {}^{m+2}C_2\right| = 1$.

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185. Evaluate: $= |10!11!12!11!12!13!12!13!14!|$

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186. Prove that: $|x + yxx5x + 4y4x2x10x + 8y8x3x| = x^3$.

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187. Show that: $\begin{vmatrix} 1 & 1+p & 1+p+q \\ 2 & 3+2p & 1+3p+2q \\ 3 & 6+3p & 1+6p+3q \end{vmatrix} = 1$.

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188. Show that: $\begin{vmatrix} a & a+b & a+b+c \\ 2a & 3a+2b & 4a+3b+2c \\ 3a & 6a+3b & 10a+6b+3c \end{vmatrix} = a^3$.

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

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190. Prove that: `determinant

$$\begin{vmatrix} 1+a & 1 & 1 \\ 1 & 1+b & 1 \\ 1 & 1 & 1+c \end{vmatrix}$$

= abc(1+1/a + 1/b + 1/c)

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191. If $a, \ b, \ c$ are the roots of the equation $x^3 + px + q = 0$, then find the value of the determinant $\begin{vmatrix} 1+a & 1 & 1 \\ 1 & 1+b & 1 \\ 1 & 1 & 1+c \end{vmatrix}$.

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192. Prove that:

$\left|(b+c)^2 a^2 a^2 b^2 (c+a)^2 b^2 c^2 c^2 (a+b)^2\right| = 2abc(a+b+c)^3$

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193. Show that: $\left|(b+c)^2 bacaab(c+a)^2 cbacbc(a+b)^2\right| = 2abc(a+b+c)^3$

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194. Show that: |1+a^2-b^2 2a b-2b2a b1-a^2+b^2 2a2b-2a1-a^2-b^2|= (1+a^2+b^2)^3`

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195. Show that: $\left|b^2+c^2 abacbac^2+a^2 bacba^2+b^2\right| = 4a^2 b^2 c^2$.

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196. Prove that: $|abax+bybcbx+cyax+bybx+cy0| = \left(b^2-ac\right)\left(ax^2+2bxy+cy^2\right)$

.

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197. Without expanding the determinant, show that $(a+b+c)$ is a factor of the determinant of .

$$\begin{pmatrix} a & b & c \\ b & c & a \\ c & a & b \end{pmatrix}$$

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198. If $a,\ b,\ c$ are roots of the equation $x^3+px+q=0$, prove that detrminant of`

$$\begin{bmatrix} a & b & c \\ b & c & a \\ c & a & b \end{bmatrix}$$

is zero

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199. Find $\frac{dy}{dx}$ if $y=\cos^2 x$

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200. If $a+b+c\neq 0$ and ,

$$\begin{vmatrix} a & b & c \\ b & c & a \\ c & a & b \end{vmatrix}$$

=0 then prove that $a=b=c$

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201. If a, b, c are real numbers, prove that `

$$\begin{vmatrix} a & b & c \\ b & c & a \\ c & a & b \end{vmatrix}$$

$=-(a+b+c)(c+bw+cw^2)(a+bw^2+cw), where$ w` is a complex cube root of unity.

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202. Show that:

$$|ab- \quad +ba+cbc-aa- \quad +ac| = (a+b+c)\left(a^2+b^2+c^2\right).$$

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203. Using properties of determinants. Prove that

$$\begin{vmatrix} 3a & -a+b & -a+c \\ -b+a & 3b & -b+c \\ -c+a & -c+b & 3c \end{vmatrix} = 3(a+b+c)(ab+bc+ca)$$

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204. Using properties of determinants, solve for

$$x : \begin{vmatrix} a+x & a-x & a-x \\ a-x & a+x & a-x \\ a-x & a-x & a+x \end{vmatrix} = 0$$

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205. Using properties of determinants, solve the following for x:

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

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206. If a,b,c are all distinct and $\begin{vmatrix} a & a^3 & a^4-1 \\ b & b^3 & b^4-1 \\ c & c^3 & c^4-1 \end{vmatrix}$ =0, show that abc(ab+bc+ac) = a+b+c

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207. If a, b, c are all positive and are pth, qth and rth terms of a G.P., then '

$$\begin{vmatrix} loga & p & 1 \\ logb & q & 1 \\ logc & r & 1 \end{vmatrix}$$

=0

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208. If $x+y+z=0$ prove that

$|xaybzcyczaxbzbxcyay| = xyz|abccabbca|$

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209. Prove that:

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

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210. Prove that: $\begin{vmatrix} bc-a^2 & ca-b^2 & ab-c^2 \\ ca-b^2 & ab-c^2 & bc-a^2 \\ ab-c^2 & bc-a^2 & ca-b^2 \end{vmatrix}$ is divisible by $a+b+c$ and find the quotient.

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211. Find a quadratic polynomial $\varphi(x)$ whose zeros are the maximum and minimum values of the function $f(x) = \begin{vmatrix} 1+\sin^2 x & \cos^2 x & \sin 2x \\ \sin^2 x & 1+\cos^2 x & \sin 2x \\ \sin^2 x & \cos^2 x & 1+\sin 2x \end{vmatrix}$

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212. $f(x) = \begin{vmatrix} \sec x & \cos x & \sec^2 x + \cot x \cos ecx \\ \cos^2 x & \cos^2 x & \cos ec^2 x \\ 1 & \cos^2 x & \cos^2 x \end{vmatrix}$ then $\int_0^{\frac{\pi}{2}} f(x) dx = \ldots\ldots$

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213. Let $\mathrm{T}_r = \begin{vmatrix} r & x & \frac{n(n+1)}{2} \\ 2r-1 & y & n^2 \\ 3r-2 & z & \frac{n(3n-1)}{2} \end{vmatrix}$ .where T is the determinant of the given matrix, Then show that $\sum_{r=1}^{n} \mathrm{T}_r = 0$.

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214. If $\text{Delta}_r = \begin{vmatrix} 2^{r-1} & 2.\ 3^{r-1} & 4.\ 5^{r-1} \\ x & y & z \\ 2^n - 1 & 3^n - 1 & 5^n - 1 \end{vmatrix}$ Show that $\sum_{r=1}^{n} \text{Delta}_r$= Constant

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215. If m is a positive integer and $D_r = \begin{vmatrix} 2r - 1 & {}^mC_r & 1 \\ m^2 - 1 & 2^m & m + 1 \\ \sin^2(m^2) & \sin^2(m) & \sin^2(m+1) \end{vmatrix}$. Prove that $\sum_{r=0}^{m} D_r = 0$.

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216. Without expanding evaluate the determinant $\text{Delta} = \begin{vmatrix} 1 & 1 & 1 \\ a & b & c \\ a^2 & b^2 & c^2 \end{vmatrix}$.

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217. Without expanding,FIND `"Delta"=|(((a-x)^2),((a-y)^2),((a-z)^2)),(((b-x)^2),((b-y)^2),((b-z)^2)),(((c-x)^2),((c-y)^2),((c-z)^2))|

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218. Prove that: $\begin{vmatrix} -2a & a+b & a+c \\ b+a & -2b & b+c \\ c+a & c+b & -2c \end{vmatrix} = 4(a+b)(b+c)(c+a)$

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219. Evaluate the following determinant: $\begin{vmatrix} 1 & 3 & 5 \\ 2 & 6 & 10 \\ 31 & 11 & 38 \end{vmatrix}$

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220. Evaluate the following determinant: $\begin{vmatrix} 1 & 4 & 9 \\ 4 & 9 & 16 \\ 9 & 16 & 25 \end{vmatrix}$

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221. Without expanding, show that the value of each of the following determinant is zero:

$$\begin{vmatrix} 8 & 2 & 7 \\ 12 & 3 & 5 \\ 16 & 4 & 3 \end{vmatrix}$$

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222. Without expanding, show that the value of each of the following determinants is zero: $\left|1/a, a^2bc1/\ \hat{}\ 2ac1/\ \hat{}\ 2ab\right|$ (ii) $\left|a+b2a+b3a+b2a+b3a+b4a+b4a+b5a+b6a+b\right|$ (iii) $\left|1aa^21\ \hat{}\ 21\ \hat{}\ 2\quad -bc-ac-ab\right|$

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223. Without expanding, show that the value of the following determinant is zero: $\begin{vmatrix} 49 & 1 & 6 \\ 39 & 7 & 4 \\ 26 & 2 & 3 \end{vmatrix}$

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224. Without expanding, show that the value of each of the following determinants is zero: $|1^2 2^2 3^2 4^2 \quad 2^2 3^2 4^2 5^2 \quad 3^2 4^2 5^2 6^2 \quad 4^2 5^2 6^2 7^2|$ (ii) $|abca+2xb+2yc+2zxyz|$ (iii)

$\left|\left(2^x+2^{-x}\right)^2\left(2^x-2^{-x}\right)^2 1\left(3^x+3^{-x}\right)^2\left(3^x-3^{-x}\right)^2 1\left(4^x+4^{-x}\right)^2\left(4^x-4^{-}\right.\right.$

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225. Without expanding, show that the value of the following determinant is zero: $\begin{vmatrix} \sin\alpha & \cos\alpha & \cos(a+\delta) \\ \sin\beta & \cos\beta & \cos(\beta+\delta) \\ \sin\gamma & \cos\gamma & \cos(\gamma+\delta) \end{vmatrix}$

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226. Without expanding, show that the value of each of the following determinants is zero: $\begin{vmatrix} \sqrt{23}+\sqrt{3} & \sqrt{5} & \sqrt{5} \\ \sqrt{15}+\sqrt{46} & 5 & \sqrt{10} \\ 3+\sqrt{115} & \sqrt{15} & 5 \end{vmatrix}$.

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227. Evaluate the following: $\begin{vmatrix} 1 & a & bc \\ 1 & b & ca \\ 1 & c & ab \end{vmatrix}$

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228. Evaluate the following: $\begin{vmatrix} 0 & xy^2 & xz^2 \\ x^2y & 0 & yz^2 \\ x^2z & zy^2 & 0 \end{vmatrix}$

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229. If $\text{Delta} = \begin{vmatrix} 1 & x & x^2 \\ 1 & y & y^2 \\ 1 & z & z^2 \end{vmatrix}$, $\text{Delta}_1 = \begin{vmatrix} 1 & 1 & 1 \\ yz & zx & xy \\ x & y & z \end{vmatrix}$, then prove that $\text{Delta} + \text{Delta}_1 = 0$.

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

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

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

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233. Prove: $\begin{vmatrix} a+b+2c & a & b \\ c & b+c+2a & b \\ c & a & c+a+2b \end{vmatrix} = 2(a+b+c)^3$

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

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

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

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237. Find $\frac{dy}{dx}$ if $x - y + x^5 = \sin x$

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238. Prove:

$$\begin{vmatrix} z & x & y \\ z^2 & x^2 & y^2 \\ z^4 & x^4 & y^4 \end{vmatrix} = \begin{vmatrix} x & y & z \\ x^2 & y^2 & z^2 \\ x^4 & y^4 & z^4 \end{vmatrix} = \begin{vmatrix} x^2 & y^2 & z^2 \\ x^4 & y^4 & z^4 \\ x & y & z \end{vmatrix} = xyz(x-y)(y-z)(z-x)$$

.

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239. Prove:

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

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240. Prove: $\begin{vmatrix} (a+1)(a+2) & (a+2) & 1 \\ (a+2)(a+3) & (a+3) & 1 \\ (a+3)(a+4) & (a+4) & 1 \end{vmatrix} = -2$

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241. Prove:

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

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242. Prove: $\begin{vmatrix} 1 & a^2+bc & a^3 \\ 1 & b^2+ca & b^3 \\ 1 & c^2+ab & c^3 \end{vmatrix} = -(a-b)(b-c)(c-a)\left(a^2+b^2+c^2\right)$

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243. Prove: $\begin{vmatrix} a^2 & bc & ac+c^2 \\ a^2+ab & b^2 & ac \\ ab & b^2+bc & c^2 \end{vmatrix} = 4a^2b^2c^2$

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244. Prove: $\begin{vmatrix} x+4 & x & x \\ x & x+4 & x \\ x & x & x+4 \end{vmatrix} = 16(3x+4)$

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245. Show that $\begin{vmatrix} 1 & 1+p & 1+p+q \\ 2 & 3+2p & 1+3p+2q \\ 3 & 6+3p & 1+6p+3q \end{vmatrix} = 1$

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246. Prove: $\begin{vmatrix} a & b-c & c-b \\ a-c & b & c-a \\ a-b & b-a & c \end{vmatrix} = (a+b-c)(b+c-a)(c+a-b)$

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247. Prove: $\begin{vmatrix} a^2 & 2ab & b^2 \\ b^2 & a^2 & 2ab \\ 2ab & b^2 & a^2 \end{vmatrix} = \left(a^3+b^3\right)^2$

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248. Prove: $\begin{vmatrix} a^2+1 & ab & ac \\ ab & b^2+1 & bc \\ ca & cb & c^2+1 \end{vmatrix} = 1+a^2+b^2+c^2$

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249. Prove: $\begin{vmatrix} 1 & a & a^2 \\ a^2 & 1 & a \\ a & a^2 & 1 \end{vmatrix} = \left(a^3 - 1\right)^2$

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250. Prove:

$|a + b + c - c - b - ca + b + c - a - b - aa + b + c| = 2(a + b)(b + c)($

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251. Prove: $\begin{vmatrix} b + c & a & a \\ b & c + a & b \\ c & c & a + b \end{vmatrix} = 4abc$

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252. Show that $\begin{vmatrix} b^2+c^2 & ab & ac \\ ba & c^2+a^2 & bc \\ ca & cb & a^2+b^2 \end{vmatrix} = 4a^2b^2c^2$

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253. Prove: $\begin{vmatrix} 0 & b^2a & c^2a \\ a^2b & 0 & c^2b \\ a^2c & b^2c & 0 \end{vmatrix} = 2a^3b^3c^3$

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254. Prove: $\begin{vmatrix} \frac{a^2+b^2}{c} & c & c \\ a & \frac{b^2+c^2}{a} & a \\ b & b & \frac{c^2+a^2}{b} \end{vmatrix} = 4abc$

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255. Prove: $\begin{vmatrix} -bc & b^2+bc & c^2+bc \\ a^2+ac & -ac & c^2+ac \\ a^2+ab & b^2+ab & -ab \end{vmatrix} = (ab+bc+ca)^3$

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256. By using properties of determinants. Show that: (i) $|x+42x2x2 \times \; +42x2x2 \times \; +4| = (5x-4)(4-x)^2$ (ii) $|y+kyyyy+kyyyy+k| = k^2\left(2y\dot{k}\right)^2$

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257. show 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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258. Prove: $\begin{vmatrix} y+z & z & y \\ z & z+x & x \\ y & x & x+y \end{vmatrix} = 4\,xyz$

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259. Show that $\begin{vmatrix} -a(b^2+c^2-a^2) & 2b^3 & 2c^3 \\ 2a^3 & -b(c^2+a^2-b^2) & 2c^3 \\ 2a^3 & 2b^3 & -c(a^2+b^2-C^2) \end{vmatrix}$ = abc $(a^2+b^2+c^2)^3$

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260. Prove: $\begin{vmatrix} 1+a & 1 & 1 \\ 1 & 1+a & 1 \\ 1 & 1 & 1+a \end{vmatrix} = a^3+3a^2$

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

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262. show 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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263. Using properties of determinants, prove that

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

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264. Prove: $|a^3 2ab^3 2bc^3 2c| = 2(a-b)(b-c)(c-a(a+b+c)$

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265. Without expanding, prove that

$|abcxyzpqr| = |xyzpqrabc| = |ybqxapzcr|$

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266. Show that $\begin{vmatrix} x+1 & x+2 & x+a \\ x+2 & x+3 & x+b \\ x+3 & x+4 & x+c \end{vmatrix} = 0$ where $a,\ b,\ c$ are in A.P.

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267. Show that $\begin{bmatrix} x-3 & x-4 & x-\alpha \\ x-2 & x-3 & x-\beta \\ x-1 & x-2 & x-\gamma \end{bmatrix} = 0$ where α, β, γ are in AP

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268. If $a,\ b,\ c$ are real numbers such that $\begin{vmatrix} b+c & c+a & a+b \\ c+a & a+b & b+c \\ a+b & b+c & c+a \end{vmatrix} = 0$, then show that either $a+b+c=0$ or, $a=b=c$.

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269. $a \neq p, b \neq q, c \neq r$ and $\begin{vmatrix} p & b & c \\ a & q & c \\ a & b & r \end{vmatrix} = 0$ the value of $\frac{p}{p-a} + \frac{q}{q-b} + \frac{r}{r-c} =$

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270. Show that $x = 2$ is a root of the equation $\begin{vmatrix} x & -6 & -1 \\ 2 & -3x & x-3 \\ -3 & 2x & x+2 \end{vmatrix}$=0 and solve it completely.

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

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272. Solve the following: $\begin{vmatrix} x+1 & 3 & 5 \\ 2 & x+2 & 5 \\ 2 & 3 & x+4 \end{vmatrix} = 0$

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273. Solve the following: $\begin{vmatrix} 1 & 1 & x \\ p+1 & p+1 & p+x \\ 3 & x+1 & x+2 \end{vmatrix} = 0$

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274. If a, b and c are all non-zero and $\begin{vmatrix} 1+a & 1 & 1 \\ 1 & 1+b & 1 \\ 1 & 1 & 1+c \end{vmatrix} = 0,$ then prove that $\frac{1}{a} + \frac{1}{b} + \frac{1}{c} + 1 = 0$

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275. Find the area of the triangle with vertices $A\ (5,\ 4),\ \ B(-2,\ 4)$ and $C\ (2,\ -6)$.

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

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277. If the points $(a_1, b_1),\ (a_2, b_2)$ and $(a_1+a_2,\ b_1+b_2)$ are collinear, show that $a_1b_2 = a_2b_1$.

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278. If the points $(2,\ -3),\ (\lambda,\ -1)$ and $(0,\ 4)$ are collinear, find the value of λ.

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279. Using determinants, find the area of the triangle whose vertices are (1, 4), (2, 3) and (-5, -3). Are the given points collinear?

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280. Find the equation of the line joining $A(1,\ 3)$ and $B(0,\ 0)$ using determinants and find k if $D(k,\ 0)$ is a point such that area of ABD is 3 sq. units.

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281. If $A(x_1, y_1), B(x_2, y_2) and C(x_3, y_3)$ are vertices of an equilateral triangle whose each side is equal to a , then prove that

$$\begin{vmatrix} x_1 & y_1 & 2 \\ x_2 & y_2 & 2 \\ x_3 & y_3 & 2 \end{vmatrix}^2 = 3a^4$$

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282. A triangle has its three sides equal to $a, bandc$. If the coordinates of its vertices are $A(x_1, y_1), B(x_2, y_2)andC(x_3, y_3)$, show that

$$\begin{vmatrix} x_1 & y_1 & 2 \\ x_2 & y_2 & 2 \\ x_3 & y_3 & 2 \end{vmatrix}^2 = (a+b+c)(b+c-a)(c+a-b)(a+b-c)$$

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283. Find the area of the triangle with vertices at the points: (3, 8), (-4, 2) and (5, -1)

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284. Find the area of the triangle with vertices at the points: (0, 0), (6, 0) and (4, 3)

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285. Using determinants show that the following points are collinear: (1, -1), (2, 1) and (4, 5)

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286. Find $\frac{dy}{dx}$ if $y = x^3 - x^{10}$

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287. Prove that the points $(a, 0), (0, b)$ and $(1, 1)$ are collinear if, $\frac{1}{a} + \frac{1}{b} = 1$.

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288. Using determinants prove that the points $(a, b), (a', b') and (a - a', b - b')$ are collinear if $ab' = a'b$.

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289. Prove that the points $(-2, 5), (0, 1)$ and $(2, -3)$ are collinear.

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290. Find the value of x if the area of is 35 square cms with vertices $(x, 4), (2, -6) and (5, 4).$

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291. Using determinants, find the area of the triangle whose vertices are (1, 4), (2, 3) and (-5, -3). Are the given points collinear?

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292. Using determinants, find the area of the triangle with vertices (-3, 5), (3, -6) and (7, 2).

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293. Find $\frac{dy}{dx}$ if $x = 9y^3 - 2x$

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294. If the points $(x, -2)$, $(5, 2)$ and $(8, 8)$ are collinear, find x using determinants.

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295. If the points (3, -2), $(x, 2)$ and (8 ,8) are collinear, find x using determinant.

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296. Find the value of k for which the area of tringle is 4 sq units when the coordinate of vertices are (i)$(k, 0), (4, 0), (0, 2)$ (ii)

$(-2, 0), (0, 4), (0, k)$

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297. Solve the following system of equations by Cramers rule

$2x - y = 17, 3x + 5y = 6$

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298. Solve the following system of equations using Cramers rule.

$5x - 7y + z = 11, 6x - 8y - z = 15$ and $3x + 2y - 6z = 7$

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299. Find $\frac{dy}{dx}$ if $x + 2y = 3$

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300. Show that the following system of equations is inconsistent: $2x + y = 3, \quad 4x + 2y = 5$

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301. Find $\frac{dy}{dx}$ if $y = x - 2x^4 + x^7$

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302. Using determinants, show that the following system of linear equation is inconsistent: $x - 3y + 5z = 4$, $2x - 6y + 10z = 11$, $3x - 9y + 15z = 12$

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303. Using Cramers rule, solve the following system of linear equations: $(a + b)x - (a - b)y = 4ab \ (a - b)x + (a + b)y = 2(a^2 - b^2)$

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304. Using determinants, show that the following system of equations is inconsistent: $2x - y + z = 4, \quad x + 3y + 2z = 12, \quad 3x + 2y + 3z = 10$

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305. Solve the following system of equations by using determinants: $x + y + z = 1, ax + by + cz = k, a^2x + b^2y + c^2z = k^2$

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306. The sum of three numbers is 6. If we multiply the third number 2 and add the first number to the result, we get 7. Be adding second and third numbers to three times the first number we get 12. Use determinants to find the numbers.

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

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308. If $f(x)=ax^2+bx+c$ is a quadratic function such that $f(1)=8, f(2)=11$ and $f(-3)=6$ find $f(x)$ by using determinants. Also, find $f(0)\cdot$

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309. Determine the values of λ for which the following system of equations : $\lambda x+3y-z=1,\ x+2y+z=2,\ -\lambda x+y+2z=-1$ has non-trival solutions.

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310. For what values of a and b , the following system of equations is consistent?

$x + y + z = 6$

$2x + 5y + az = b$

$x + 2y + 3z = 14$

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311. For what values of a and b, the system of equations $2x + ay + 6z = 8, \ x + 2y + bz = 5, \ x + y + 3z = 4$ has: (i) a unique solution (ii) infinitely many solutions (iii) no solution

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312. Solve the following system of linear equations by Cramers rule: $x - 2y = 4, \quad - 3x + 5y = - 7$

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313. Solve the following system of linear equations by Cramers rule:

$2x - y = 1, \quad 7x - 2y = -7$

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314. Solve the following system of linear equations by Cramers rule:

$2x - y = 17, \quad 3x + 5y = 6$

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315. Solve the following system of linear equations by Cramers rule:

$3x + y = 19, \quad 3x - y = 23$

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316. Solve the following system of linear equations by Cramers rule:

$2x - y = -2, \quad 3x + 4y = 3$

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317. Solve the following system of linear equations by Cramers rule: $3x + ay = 4, \quad 2x + ay = 2, \quad a \neq 0$

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318. Solve the following system of linear equations by Cramers rule: $2x + 3y = 10, \quad x + 6y = 4$

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319. Solve the following system of linear equations by Cramers rule: $5x + 7y = -2, \quad 4x + 6y = -3$

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320. Solve the following system of linear equations by Cramers rule:

$9x + 5y = 10, \quad 3y - 2x = 8$

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321. Solve the following system of linear equations by Cramers rule:

$x + 2y = 1, \quad 3x + y = 4$

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322. Solve the following system of the linear equations by cramer's rule

$3x + y + z = 2, 2x - 4y + 3z = -1$ and $4x + y - 3z = -11$

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323. Solve the following system of linear equations by Cramers rule:

$x - 4y - z = 11, \quad 2x - 5y + 2z = 39, \quad -3x + 2y + z = 1$

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324. Solve the following system of linear equations by Cramers rule:

$6x + y - 3z = 5, \;\; x + 3y - 2z = 5, \;\; 2x + y + 4z = 8$

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325. Solve the following system of linear equations by Cramers rule:

$x + y = 5, \;\; y + z = 3, \;\; x + z = 4$

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326. Solve the following system of linear equations by Cramers rule:

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

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327. Solve the following system of equations using Cramers rule.

$5x - 7y + z = 11, 6x - 8y - z = 15and3x + 2y - 6z = 7$

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328. Solve the following system of linear equations by Cramers rule:

$2x - 3y - 4z = 29, \quad -2x + 5y - z = -15, \quad 3x - y + 5z = -11$

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329. Solve the following system of linear equations by Cramers rule:

$x + y = 1, \quad x + z = -6, \quad x - y - 2z = 3$

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330. Solve the following system of linear equations by Cramers rule:

$x + y + z + 1 = 0, \quad ax + by + cz + d = 0, \quad a^2x + b^2y + c^2z + d^2 = 0$

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331. Solve system of equations $x + y + z + w = 1$, $x - 2y + 2z + 2w = -6$, $2x + y - 2z + 2w = -5$, $3x - y + 3z - 3w = -3$

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332.

$2x - 3z + w = 1, x - y + 2w = 1, -3y + z + w = 1, x + y + z = 1$

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333. Show that the following systems of linear equations are inconsistent:

$2x - y = 5, \ \ 4x - 2y = 7$

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334. Show that the following systems of linear equations are inconsistent: $3x + y = 5, \quad -6x - 2y = 9$

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335. Show that the following systems of linear equations are inconsistent:

$3x - y + 2z = 3, \ \ 2x + y + 3z = 5, \ \ x - 2y - z = 1$

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336. Show that the following systems of linear equations are consistent:

$3x - y + 2z = 6, \ \ 2x - y + z = 2, \ \ 3x + 6y + 5z = 20.$

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337. Show that the following systems of linear equations has infinite number of solutions

$x - y + z = 3, \quad 2x + y - z = 2, \quad -x - 2y + 2z = 1$

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338. Show that the following systems of linear equations has infinite number of solutions and solve $x + 2y = 5, \ \ 3x + 6y = 15$

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339. Solve the following system of homogeneous equations: $x + y - z = 0 \; x - 2y + z = 0 \; 3x + 6y - 5z = 0$

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340. Show that the following systems of linear equations has infinite number of solutions and solve $2x + y - 2z = 4, \ \ x - 2y + z = -2, \ \ 5x - 5y + z = -2$

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341. Show that the following systems of linear equations has infinite number of solutions and solve

$x - y + 3z = 6, \ x + 3y - 3z = -4, \ 5x + 3y + 3z = 10$

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342. A salesman has the following record of sales during three months for three items A, B and C which have different rates of commission Month, Sale of units, Total commissiondrawn (in Rs) Find out the rates of commission on items A, B and C by using deter-minant method.

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343. An automobile company uses three types of steel $S_1, \ S_2 \, and \, S_3$ for producing three types of cars $C_1, \ C_2 \, and \, C_3$. Steel requirements (in tons) for each type of cars are given below: $\begin{bmatrix} SteelCars & C_1 & C_2 & C_3 \\ S_1 & 2 & 3 & 4 \\ S_2 & 1 & 1 & 2 \\ S_3 & 3 & 2 & 1 \end{bmatrix}$

Using Cramers rule, find the number of cars of each type which can be produced using 29, 13 and 16 tonnes of steel of three types respectively.

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344. Solve the following system of equations $3x - 4y + 5z = 0, x + y - 2z = 0, 2x + 3y + z = 0$

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345. Solve the following system of homogeneous equations: $x + y + z = 0 \; x - 2y + z = 0 \; 3x + 6y - 5z = 0$

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346. Find the value of λ for which the homogeneous system of equations: $2x + 3y - 2z = 0 \quad 2x - y + 3z = 0 \quad 7x + \lambda y - z = 0$ has non-trivial solutions. Find the solution.

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347. If the system of equations $x = cy + bz,\ \ y = az + cx,\ \ z = bx + ay$ has a non-trivial solution show that $a^2 + b^2 + c^2 + 2abc = 1$

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348. If a, b, c are distinct real numbers and the system of equations $ax + a^2y + (a^3 + 1)z = 0$ $bx + b^2y + (b^3 + 1)z = 0$ $cx + c^2y + (c^3 + 1) = 0$ has a non-trivial solution, show that $abc = -1$

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349. If x, y, z are have not triavle solution such that $ax + y + z = 0$ $x + by + z = 0$ $x + y + cz = 0$ then prove that 1/(1-a)+1/(1-b)+1/(1-c)=1

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350. Solve following system of homogeneous linear equations:

$x+y-2z=0, \; 2x+y-3z=0, \; 5x+4y-9z=0$

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351. Solve following system of homogeneous linear equations:

$2x+3y+4z=0, \; x+y+z=0, \; 2x+5y-2z=0$

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352. Solve following system of homogeneous linear equations:

$3x+y+z=0, \; x-4y+3z=0, \; 2x+5y-2z=0$

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353. Find the real values of λ for which the following system of linear equations has non-trivial solutions. Also, find the non-trivial solutions.

$2\lambda x - 2y + 3z = 0 \; x + \lambda y + 2z = 0 \; 2x + \lambda z = 0$

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354. If a, b, c are non-zero real numbers and if the system of equations $(a-1)x = y = z \; (b-1)y = z + x \; (c-1)z = x + y$ has a non-trivial solution, then prove that $ab + bc + ca = abc$

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355. If A is a singular matrix, then write the value of $|A|$.

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356. For what value of x, the matrix $\begin{bmatrix} 5-x & x+1 \\ 2 & 4 \end{bmatrix}$ is singular?

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357. Write the value of the determinant $\begin{vmatrix} 2 & 3 & 4 \\ 5 & 6 & 8 \\ 6x & 9x & 12x \end{vmatrix}$.

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358. State whether the matrix $\begin{bmatrix} 2 & 3 \\ 6 & 4 \end{bmatrix}$ is singular or nonsingular.

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359. Find the value of the determinant $\begin{vmatrix} 4200 & 4201 \\ 4202 & 4203 \end{vmatrix}$.

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360. Find the value of the determinant $\begin{vmatrix} 101 & 102 & 103 \\ 104 & 105 & 106 \\ 107 & 108 & 109 \end{vmatrix}$

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361. Write the value of the determinant $\begin{vmatrix} a & 1 & b+c \\ b & 1 & c+a \\ c & 1 & a+b \end{vmatrix}$.

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362. If $A = \begin{bmatrix} 0 & i \\ i & 1 \end{bmatrix}$ and $B = \begin{bmatrix} 0 & 1 \\ 1 & 0 \end{bmatrix}$, find the value of $|A| + |B|$.

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363. If $A = \begin{bmatrix} 1 & 2 \\ 3 & -1 \end{bmatrix}$ and $B = \begin{bmatrix} 1 & 0 \\ -1 & 0 \end{bmatrix}$, find $|AB|$.

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364. Evaluate: $\begin{vmatrix} 4785 & 4787 \\ 4789 & 4791 \end{vmatrix}$.

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365. If w is an imaginary cube root of unity, find the value of

$$\begin{vmatrix} 1 & w & w^2 \\ w & w^2 & 1 \\ w^2 & 1 & w \end{vmatrix}.$$

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366. If $A = \begin{bmatrix} 1 & 2 \\ 3 & -1 \end{bmatrix}$ and $B = \begin{bmatrix} 1 & -4 \\ 3 & -2 \end{bmatrix}$, find $|AB|$.

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367. If $A = [a_{ij}]$ is a 3×3 diagonal matrix such that $a_{11} = 1$, $a_{22} = 2$ and $a_{33} = 3$, then find $|A|$.

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368. If $A = [a_{ij}]$ is a 3×3 scalar matrix such that $a_{11} = 2$, then write the value of $|A|$.

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369. If I_3 denotes identity matrix of order 3×3 , write the value of its determinant.

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370. A matrix A of order $3X3$ has determinant 5. What is the value of $|3A|$?

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371. On expanding by first row, the value of the determinant of 3×3 square matrix $A = [a_{ij}]$ is $a_{11}C_{11} + a_{12}C_{12} + a_{13}C_{13} + a_{32}C_{32} + a_{33}C_{33}$.

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372. If $A = (a_{ij})$ is a 4×4 matrix and C_{ij}, is the co-factor of the element a_{ij}, in $Det(A)$, then the expression $a_{11}C_{11} + a_{12}C_{12} + a_{13}C_{13} + a_{14}C_{14}$ equals-

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373. Write the value of $\begin{vmatrix} \sin 20^\circ & -\cos 20^\circ \\ \sin 70^\circ & \cos 70^\circ \end{vmatrix}$.

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374. If A is a square matrix of order n and $AA^T = I$ then find $|A|$

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375. If A and B are square matrices of the same order such that $|A| = 3$ and $AB = I$, then write the value of $|B|$.

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376. A is a skew-symmetric of order 3, write the value of $|A|$.

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377. If A is a square matrix of order 3 with determinant 4, then write the value of $|-A|$.

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378. If A is a square matrix such that $|A|=2$, write the value of $|2A|$

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379. Find the value of determinant $\begin{vmatrix} 243 & 156 & 300 \\ 81 & 52 & 100 \\ -3 & 0 & 4 \end{vmatrix}$.

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380. Write the value of the determinant $\begin{vmatrix} 2 & -3 & 5 \\ 4 & -6 & 10 \\ 6 & -9 & 15 \end{vmatrix}$.

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381. If the matrix $\begin{bmatrix} 5x & 2 \\ -10 & 1 \end{bmatrix}$ is singular, find the value of x .

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382. If A is a square matrix of order $n \times n$ such that $|A| = \lambda$, then write the value of $|-A|$.

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383. Find the value of the determinant $\begin{vmatrix} 2^2 & 2^3 & 2^4 \\ 2^3 & 2^4 & 2^5 \\ 2^4 & 2^5 & 2^6 \end{vmatrix}$.

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384. If A and B are non-singular matrices of the same order, write whether AB is singular or non-singular.

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385. A matrix of order 3×3 has determinant 2. What is the value of $|A(3I)|$, where I is the identity matrix of order 3×3.

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386. If A and B are square matrices of order 3 such that $|A| = -1$, $|B| = 3$, then find the value of $|3AB|$.

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387. Write the value of $\begin{vmatrix} a+ib & c+id \\ -c+id & a-ib \end{vmatrix}$.

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388. Write the cofactor of a_{12} in the matrix $\begin{bmatrix} 2 & -3 & 5 \\ 6 & 0 & 4 \\ 4 & 5 & -7 \end{bmatrix}$

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389. If $\begin{vmatrix} 2x+5 & 3 \\ 5x+2 & 9 \end{vmatrix} = 0$, find x.

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390. Find the value of x from the following: $\begin{vmatrix} x & 4 \\ 2 & 2x \end{vmatrix} = 0$

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391. Write the value of the determinant $\begin{vmatrix} 2 & 3 & 4 \\ 5 & 6 & 8 \\ 6x & 9x & 12x \end{vmatrix}$

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392. If $|A| = 2$, where A is 2×2 matrix, find $|adj\ A|$.

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393. What is the value of the determinant $\begin{vmatrix} 0 & 2 & 0 \\ 2 & 3 & 4 \\ 4 & 5 & 6 \end{vmatrix}$?

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394. For what value of x is the matrix $\begin{bmatrix} 6-x & 4 \\ 3-x & 1 \end{bmatrix}$ singular?

A. 1

B. 0

C. 2

D. -1

Answer: C

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395. A matrix A of order 3×3 is such that $|A| = 4$. Find the value of $|2A|$.

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396. Evaluate: $\begin{vmatrix} \cos 15^\circ & \sin 15^\circ \\ \sin 75^\circ & \cos 75^\circ \end{vmatrix}$.

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397. If $A = \begin{bmatrix} 5 & 3 & 8 \\ 2 & 0 & 1 \\ 1 & 2 & 3 \end{bmatrix}$. Write the cofactor of the element a_{32}.

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

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399. If $\begin{vmatrix} 2x & x+3 \\ 2(x+1) & x+1 \end{vmatrix} = \begin{vmatrix} 1 & 5 \\ 3 & 5 \end{vmatrix}$, then write the value of x.

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400. If $\begin{vmatrix} 3x & 7 \\ -2 & 4 \end{vmatrix} = \begin{vmatrix} 8 & 7 \\ 6 & 4 \end{vmatrix}$, find the value of x.

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401. If $\begin{vmatrix} 2x & 5 \\ 8 & x \end{vmatrix} = \begin{vmatrix} 6 & -2 \\ 7 & 3 \end{vmatrix}$, write the value of x.

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402. If A is square matrix of order 3 matrix, $|A| \neq 0$ and $|3A| = k|A|$, then write the value of k .

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403. Write the value of the determinant $\begin{vmatrix} p & p+1 \\ p-1 & p \end{vmatrix}$.

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404. Write the value of $\begin{vmatrix} x+y & y+z & z+x \\ z & x & y \\ -3 & -3 & -3 \end{vmatrix}$

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405. If $A = \begin{bmatrix} \cos\theta & \sin\theta \\ -\sin\theta & \cos\theta \end{bmatrix}$, then for any natural number, find the value of $Det\ (A^n)$.

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406. The maximum value of $\begin{vmatrix} 1 & 1 & 1 \\ 1 & 1+\sin\theta & 1 \\ 1 & 1 & 1+\cos\theta \end{vmatrix}$ is

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407. If $x \in N$ and $\begin{vmatrix} x+3 & -2 \\ -3x & 2x \end{vmatrix} = 8$, then find the value of x.

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408. If $\begin{vmatrix} x & \sin\theta & \cos\theta \\ -\sin\theta & -x & 1 \\ \cos\theta & 1 & x \end{vmatrix} = 8$, write the value of x.

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409. If A and B are square matrices of order 2, then $\det(A+B)=0$ is possible only when (a)$\det(A)=0$ or $\det(B)=0$ (b) $\det(A)+\det(B)=0$ (c) $\det(A)=0$ and $\det(B)=0$ (d) $A+B=O$

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410. Which of the following is not correct? (a)$|A| = |A^T|$, where $A = [a_{ij}]_{3\times 3}$ (b) $|kA| = k^3|A|$, where $A = [a_{ij}]_{3\times 3}$ (c) If A is a skew-symmetric matrix of odd order, then $|A| = 0$ (d) $\begin{vmatrix} a+b & c+d \\ e+f & g+h \end{vmatrix} = \begin{vmatrix} a & c \\ e & g \end{vmatrix} + \begin{vmatrix} b & d \\ f & h \end{vmatrix}$

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411. If $\Delta = \begin{vmatrix} a_{11} & a_{12} & a_{13} \\ a_{21} & a_{22} & a_{23} \\ a_{31} & a_{32} & a_{33} \end{vmatrix}$ and A_{ij} is cofactors of a_{ij} , then value of Δ is given by

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412. Which of the following is not correct in a given determinant of A, where $A = \left(\left[a_{ij}\right]\right)_{3x3}$ (A).Order of minor is less than order of the det (A) (B).Minor of an element can never be equal to cofactor of the same element (C).Value of a determinant is obtained by multiplying elements of a row or column by corresponding cofactors (D).Order of minors and cofactors of elements of A is same

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413. Let $\begin{vmatrix} x & 2 & x \\ x^2 & x & 6 \\ x & x & 6 \end{vmatrix} = ax^4 + bx^3 + cx^2 + dx + e$. Then, the value of $5a + 4b + 3c + 2d + e$ is equal (a)0 (b) -16 (c) 16 (d) none of these

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414. The value of the determinant $\left|a^2 a 1 \cos nx \cos(n+a)x \cos(n+2)x \sin nx \sin(n+1)x \sin(n+2)x\right|$ is independent of n (b) a (c) x (d) none of these

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415. If $A = \begin{vmatrix} 1 & 1 & 1 \\ a & b & c \\ a^2 & b^2 & c^2 \end{vmatrix}, B = \begin{vmatrix} 1 & bc & a \\ 1 & ca & b \\ 1 & ab & c \end{vmatrix}$, then

A. a. $A + B = 0$

B. b. $A + 2B = 0$

C. c. $A = B$

D. d. None of these

Answer: null

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416. If $D_k = \begin{vmatrix} 1 & n & n \\ 2k & n^2+n+1 & n^2+n \\ 2k-1 & n^2 & n^2+n+1 \end{vmatrix}$ and $\sum_{k=1}^{n} D_k = 56.$

then n equals 4 b. 6 c. 8 d. none of these

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417. Let $\begin{vmatrix} x^2+3x & x-1 & x+3 \\ x+1 & -2x & x-4 \\ x-3 & x+4 & 3x \end{vmatrix} = ax^4+bx^3+cx^2+e$ be an identity

in x, where a, b, c, d, e are independent of $x \cdot$ Then the value of e is (a) 4

(b) 0 (c) 1 (d) none of these

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418. Using the factor theorem it is found that $a+b$, $b+c$ and $c+a$ are three factors of the determinant $\begin{vmatrix} -2a & a+b & a+c \\ b+a & -2b & b+c \\ c+a & c+b & -2c \end{vmatrix}$. The other factor in the value of the determinant is (a)4 (b) 2 (c)$a+b+c$ (d) none of these

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419. If a, b, c are different, then the value of $\begin{vmatrix} 0 & x^2-a & x^3-b \\ x^2+a & 0 & x^2+c \\ x^4+b & x-c & 0 \end{vmatrix}$ is

a. b b. c c. b d. 0

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420. If the determinant $\begin{vmatrix} a & b & 2a\alpha+3b \\ b & c & 2b\alpha+3c \\ 2a\alpha+3b & 2b\alpha+3c & 0 \end{vmatrix} = 0$ then (a) a, b, c are in H.P. (b)α is root of $4ax^2+12bx+9c=0$ or(c) a, b, c are in G.P. (d)$a, b, c,$ are in G.P. only a, b, c are in A.P.

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421. If $1.\ \omega, \omega^2$ are the roots of unity, then $\Delta = \begin{vmatrix} 1 & \omega^n & \omega^{2n} \\ \omega^n & \omega^{2n} & 1 \\ \omega^{2n} & 1 & \omega^n \end{vmatrix}$ is equal to

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422. If $A_r = \begin{vmatrix} 1 & r & 2^r \\ 2 & n & n^2 \\ n & \frac{n(n+1)}{2} & 2^{n+1} \end{vmatrix}$, then the value of $\sum_{r=1}^{n} A_r$ is n (b) $2n$ (c) $-2n$ (d) n^2

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423. If $a > 0$ and discriminant of $ax^2 + 2bx + c$ is negative, then $\begin{vmatrix} a & b & ax+b \\ b & c & bx+c \\ ax+b & bx+c & 0 \end{vmatrix}$ is a. $+ve$ b. $(ac-b)^2(ax^2+2bx+c)$ c. $-ve$ d. 0

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424. The value of $\begin{vmatrix} 5^2 & 5^3 & 5^4 \\ 5^3 & 5^4 & 5^5 \\ 5^4 & 5^5 & 5^6 \end{vmatrix}$ is (a)5^2 (b) 0 (c) 5^{13} (d) 5^9

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425. $\begin{vmatrix} (\log)_3 512 & (\log)_4 3 \\ (\log)_3 8 & (\log)_4 9 \end{vmatrix} \times \begin{vmatrix} (\log)_2 3 & (\log)_8 3 \\ (\log)_3 4 & (\log)_3 4 \end{vmatrix} =$ (a) 7 (b) 10 (c) 13 (d) 17

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426. If a, b, c, are in A.P, then the determinant $\begin{vmatrix} x+2 & x+3 & x+2a \\ x+3 & x+4 & x+2b \\ x+4 & x+5 & x+2c \end{vmatrix}$ is(A) 0 (B) 1 (C) x (D) 2x

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427. If $A+B+C=\pi,$ then the value of

$|\sin(A+B+C)\sin(A+C)\cos C - \sin B 0 \tan C \cos(A+B)\tan(B+C)0$

0 (b) 1 (c) $2 \sin B \tan A \cos C$ (d) none of these

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428. The number of distinct real roots of $\begin{vmatrix} \cos ecx & \sec x & \sec x \\ \sec x & \cos ecx & \sec x \\ \sec x & \sec x & \cos ecx \end{vmatrix} = 0$ lies in the interval $-\frac{\pi}{4} \leq x \leq \frac{\pi}{4}$ is (a) 1 (b) 2 (c) 3 (d) 0

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429. Let $A = \begin{vmatrix} 1 & \sin\theta & 1 \\ -\sin\theta & 1 & \sin\theta \\ -1 & -\sin\theta & 1 \end{vmatrix}$, where $0 \leq \theta \leq 2\pi$. Then (a) $Det(A) = 0$ (b) $Det(A) \in (2, \infty)$ (c)$Det(A) \in (2, 4)$ (d) $Det(A) \in [2, 4]$

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430. If $\begin{vmatrix} 2x & 5 \\ 8 & x \end{vmatrix} = \begin{vmatrix} 6 & -2 \\ 7 & 3 \end{vmatrix}$, then $x =$ (a) 3 (b) ± 3 (c) ± 6 (d) 6

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431. If $f(x) = \begin{vmatrix} 0 & x-a & x-b \\ x+a & 0 & x-c \\ x+b & x+c & 0 \end{vmatrix}, then$ (a) $f(a) = 0$ (b) $f(b) = 0$ (c) $f(0) = 0$ (d) $f(1) = 0$

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432. The value of the determinant $\begin{vmatrix} a-b & b+c & a \\ b-a & c+a & b \\ c-a & a+b & c \end{vmatrix}$ is (a) $a^3 + b^3 + c^3$ (b) $3\,bc$ (c) $a^3 + b^3 + c^3 - 3abc$ (d) none

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433. If x, y, z are different from zero and $\begin{vmatrix} 1+x & 1 & 1 \\ 1 & 1+y & 1 \\ 1 & 1 & 1+z \end{vmatrix} = 0$ then the value of $x^{-1} + y^{-1} + z^{-1}$ is (a) xyz (b) $x^{-1}y^{-1}z^{-1}$ (c) $-x-y-z$ (d) -1

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434. The determinant $\begin{vmatrix} b^2-ab & b-c & bc-ac \\ ab-a^2 & a-b & b^2-ab \\ bc-ca & c-a & ab-a^2 \end{vmatrix}$ equals (a) $abc\,(b-c)(c-a)(a-b)$ (b) $(b-c)(c-a)(a-b)$ (c) $(a+b+c)(b-c)(c-a)(a-b)$ (d) none of these

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435. If $x, y \in R,$ then the determinant $= \begin{vmatrix} \cos x & -\sin x & 1 \\ \sin x & \cos x & 1 \\ \cos(x+y) & -\sin(x+y) & 0 \end{vmatrix}$ lies in the interval (a) $\left[-\sqrt{2}, \sqrt{2}\right]$ (b) $[-1, 1]$ (c) $\left[-\sqrt{2}, 1\right]$ (d) $\left[-1, -\sqrt{2}\right]$

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436. The maximum value of $= \begin{vmatrix} 1 & 1 & 1 \\ 1 & 1+\sin\theta & 1 \\ 1+\cos\theta & 1 & 1 \end{vmatrix}$ $(\theta isreal)$ (a) $\frac{1}{2}$ (b) $\frac{\sqrt{3}}{2}$ (c) $\sqrt{2}$ (d) $-\frac{\sqrt{3}}{2}$

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437. The value of the determinant $\begin{vmatrix} x & x+y & x+2y \\ x+2y & x & x+y \\ x+y & x+2y & x \end{vmatrix}$ is (a) $9x^2(x+y)$ (b) $9y^2(x+y)$ (c)$3y^2(x+y)$ (d) $7x^2(x+y)$

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438. Let $f(x) = \begin{vmatrix} \cos x & x & 1 \\ 2\sin x & x & 2x \\ \sin x & x & x \end{vmatrix}$, then $(\lim)_{x \to 0} \frac{f(x)}{x^2}$ is equal to (a) 0 (b) -1 (c) 2 (d) 3

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439. If there are two values of a which makes determinant,

$\Delta = \begin{vmatrix} 1 & -2 & 5 \\ 2 & a & -1 \\ 0 & 4 & 2a \end{vmatrix} = 86$ then the sum of these number is

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440. If $\Delta = \begin{vmatrix} a & p & x \\ b & q & y \\ c & r & z \end{vmatrix} = 16$ then $\Delta_1 = \begin{vmatrix} p+x & a+x & a+p \\ q+y & b+y & b+q \\ r+z & c+z & c+r \end{vmatrix} = 32$

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441. The value of $\begin{vmatrix} 1 & 1 & 1 \\ {}^{n}C_1 & {}^{n+2}C_1 & {}^{n+4}C_1 \\ {}^{n}C_2 & {}^{n+2}C_2 & {}^{n+4}C_2 \end{vmatrix}$ is (a) 2 (b) 4 (c) 8 (d) n^2

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