

MATHS

BOOKS - KC SINHA MATHS (HINGLISH)

DETERMINANTS - FOR COMPETITION

Solved Examples

1. For a fixed positive integer n if $D = \begin{vmatrix} n! & (n+1)! & (n+2)! \\ (n+1)! & (n+2)! & (n+3)! \\ (n+2)! & (n+3)! & (n+4)! \end{vmatrix}$
the show that $\frac{D}{(n!)^3} - 4$ is divisible by n .



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2. If $y = \frac{u}{v}$, where u and v are functions of x , show that

$$v^3 \frac{d^2y}{dx^2} = \begin{vmatrix} u & v & 0 \\ u' & v & v \\ u'' & v'' & 2v' \end{vmatrix}.$$



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3. Show that the value of a third order determinant whose all elements are 1 or -1 is an even number.



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4.

Prove

that:

$$\begin{vmatrix} \sin \alpha & \cos \alpha & 1 \\ \sin \beta & \cos \beta & 1 \\ \sin \gamma & \cos \gamma & 1 \end{vmatrix} = \sin(\alpha - \beta) + \sin(\beta - \gamma) + \sin(\gamma - \alpha)$$



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5. If $f(x) = \begin{vmatrix} x^n & \sin x & \cos x \\ n! & \sin\left(\frac{n\pi}{2}\right) & \cos\left(\frac{n\pi}{2}\right) \\ a & a^2 & a^3 \end{vmatrix}$, then show that $\frac{d^n}{dx^n}[f(x)]$ at $x=0$ is 0



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6. If α, β be the real roots of $ax^2 + bx + c = 0$, and $s_n = \alpha^n + \beta^n$ then prove that $as_n + bs_{n-1} + cs_{n-2} = 0$ for all $n \in N$. Hence or otherwise

prove that $\begin{vmatrix} 3 & 1+s_1 & 1+s_2 \\ 1+s_1 & 1+s_2 & 1+s_3 \\ 1+s_2 & 1+s_3 & 1+s_4 \end{vmatrix} \geq 0$ for all real 'a,b,c.



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7. For what values of p and q the system of equations $2x + py + 6z = 8$, $x + 2y + qz = 5$, $x + y + 3z = 4$ has (i) no solution (ii) a unique solution (iii) infinitely many solutions.



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8. If $\begin{vmatrix} x^k & x^{k+2} & x^{k+3} \\ y^k & y^{k+2} & y^{k+3} \\ z^k & z^{k+2} & z^{k+3} \end{vmatrix} = (x-y)(y-z)(z-x) \left\{ \frac{1}{x} + \frac{1}{y} + \frac{1}{z} \right\}$ then $k =$



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9. Let a, b, c be positive real numbers and not all equal. The value of the

determinant $\begin{vmatrix} a & b & c \\ b & c & a \\ c & a & b \end{vmatrix}$ is necessarily (A) zero (B) positive (C) negative (D)

none of these



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10. If a, b, c are positive and are the p th, q th and r th terms respectively of a

G.P., the the value of $\begin{vmatrix} \log a & p & 1 \\ \log b & q & 1 \\ \log c & r & 1 \end{vmatrix} =$ (A) 1 (B) $pqr(\log a + \log b + \log c)$

(C) 0 (D) $a^p b^q c^r$



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11. If α, β and γ are such that $\alpha + \beta + \gamma = 0$, then

$$\begin{vmatrix} 1 & \cos \gamma & \cos \beta \\ \cos \gamma & 1 & \cos \alpha \\ \cos \beta & \cos \alpha & 1 \end{vmatrix}$$



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12.

Let

$$f(n) = a^n + b^n \text{ and } \begin{vmatrix} 3 & 1+f(1) & 1+f(2) \\ 1+f(1) & 1+f(2) & 1+f(3) \\ 1+f(2) & 1+f(3) & 1+f(4) \end{vmatrix} = k(1-a)^2(1-b)^2(1-c)^2$$

, then $k=$ (A) 0 (B) 1 (C) -1 (D) 4



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13. If $p(x)$, $q(x)$ and $r(x)$ be polynomials of degree one and a_1, a_2, a_3 be

real numbers then $\begin{vmatrix} p(a_1) & p(a_2) & p(a_3) \\ q(a_1) & q(a_2) & q(a_3) \\ r(a_1) & r(a_2) & r(a_3) \end{vmatrix} =$ (A) 0 (B) 1 (C) -1 (D) none of

these



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14. 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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15. The value of theta lying between 0 and $\frac{\pi}{2}$ and satisfying the equation

$$\begin{vmatrix} 1 + \cos^2 \theta & \sin^2 \theta & 4 \sin 4\theta \\ \cos^2 \theta & 1 + \sin^2 \theta & 4 \sin 4\theta \\ \cos^2 \theta & \sin^2 \theta & 1 + 4 \sin 4\theta \end{vmatrix} = 0 \text{ is (are) (A) } \frac{7\pi}{24} \text{ (B) } \frac{3\pi}{8} \text{ (C) } \frac{11\pi}{24} \text{ (D) } \frac{7\pi}{12}$$



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16. If x, y, z are not all zero & if

$ax + by + cz = 0, bx + cy + az = 0 \& cx + ay + bz = 0$, then prove that $x:y:z = 1:1:1$ OR $1:\omega:\omega^2$ OR $1:\omega^2:\omega$, where ω is one of the complex cube root of unity.



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17. If $f_r(x), g_r(x), h_r(x), r = 1, 2, 3$ are polynomials such that $f_r(a) = g_r(a) = h_r(a), r = 1, 2, 3$ and

$$F(x) = |f_1(x)f_2(x)f_3(x)g_1(x)g_2(x)g_3(x)h_1(x)h_2(x)h_3(x)| \quad \text{then}$$

$$F'(x) \text{ at } x = a \text{ is } \underline{\hspace{100pt}}$$



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18. If $f_r(x), g_r(x), h_r(x), r = 1, 2, 3$ are differentiable function and

$$y = \begin{vmatrix} f_1(x) & g_1(x) & h_1(x) \\ f_2(x) & g_2(x) & h_2(x) \\ f_3(x) & g_3(x) & h_3(x) \end{vmatrix} \text{ then } \frac{dy}{dx} = \begin{vmatrix} f'_1(x) & g'_1(x) & h'_1(x) \\ f'_2(x) & g'_2(x) & h'_2(x) \\ f'_3(x) & g'_3(x) & h'_3(x) \end{vmatrix} + \begin{vmatrix} f_1(x) & g_1(x) & h_1(x) \\ f_2(x) & g_2(x) & h_2(x) \\ f_3(x) & g_3(x) & h_3(x) \end{vmatrix}$$

On the basis of above information, answer the following question: Let

$$f(x) = \begin{vmatrix} x^4 & \cos x & \sin x \\ 24 & 0 & 1 \\ a & a^2 & a^3 \end{vmatrix}, \quad \text{where } a \text{ is a constant. Then at}$$

$$x = \frac{\pi}{2}, \frac{d^4}{dx^4}\{f(x)\} \text{ is (A) 0 (B) } a \text{ (C) } a + a^3 \text{ (D) } a + a^4$$



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$$19. \text{ If } f(x) = \begin{vmatrix} \cos(x + \alpha) & \cos(x + \beta) & \cos(x + \gamma) \\ \sin(x + \alpha) & \sin(x + \beta) & \sin(x + \gamma) \\ \sin(\beta - \gamma) & \sin(\gamma - \alpha) & \sin(\alpha - \beta) \end{vmatrix} \text{ and } f(2) = 6, \text{ then}$$

$$\text{find } \frac{1}{5} \sum_{r=1}^{25} f(r),$$



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20. If $\begin{vmatrix} x & x+y & x+y+z \\ 2x & 3x+2y & 4x+3y+2z \\ 3x & 6x+3y & 10x+6y+3z \end{vmatrix} = 64$ then the real value of x is



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21. If $Y = sX$ and $Z = tX$, where all the letters denotes the functions of x and suffixes denotes the differentiation wrt x then prove that

$$\begin{vmatrix} X & Y & Z \\ X_1 & Y_1 & Z_1 \\ X_2 & Y_2 & Z_2 \end{vmatrix} = X^3 \begin{vmatrix} s_1 & t_1 \\ s_2 & t_2 \end{vmatrix}$$



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Exercise

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



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2. Evaluate: $\Delta \begin{vmatrix} 1 + a_1 & a_2 & a_3 \\ a_1 & 1 + a_2 & a_3 \\ a_1 & a_2 & 1 + a_3 \end{vmatrix}$



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3. Evaluate: $|(b+c, a, a), (b, c+a, b), (c, c, a+b)|$



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4. 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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5. If $p + q + r = 0$ and $\begin{vmatrix} pa & qb & rc \\ qc & ra & pb \\ rb & pc & qa \end{vmatrix} = \lambda \begin{vmatrix} a & b & c \\ c & a & b \\ b & c & a \end{vmatrix}$ then $\lambda =$



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6. Without expanding a determinant at any stage, show that
 $|x^2 + \times + 1x - 22x^2 + 3x - 13x^3x - 3x^2 + 2x + 32x - 12x - 1| = xA$
are determinant of order 3 not involving x .



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7. If $f, g, and h$ are differentiable functions of x and $(x) = |fgh(xf)'(xg)'(xh)'(x^{f^2}f)''(x^2g)''(x^2h)''|$ prove that
 $\wedge ('') = |fgff'g'h'(x^3f'')'(x^3g'')'(x^3h'')'|$



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8. Let λ and α real. Find the set of all values of lamda for which the system.

$x + (\sin \alpha)y + (\cos \alpha)z = 0, x + (\cos \alpha)y + (\sin \alpha)z = 0, -x + (\sin \alpha)y$
has a non trivial solution. For $\lambda = 1$ find all values of alpa.



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9. Show that if $x_1, x_2, x_3 \neq 0$

$$|x_1 + a_1 b_1 a_1 b_2 a_1 b_3 a_2 b_1 x_2 + a_2 b_2 a_2 b_3 a_3 b_1 a_3 b_2 x_3 + a_3 b_3| = x_1 x_2 x_3 \left(1 + \frac{a_1 b_1}{x_1}\right)$$



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10. If $y = \sin px$ and y_n is the n^{th} derivative of y , then

$|y y_1 y_2 y_3 y_4 y_5 y_6 y_7 y_8|$ is
(a) 1 (b) 0 (c) -1 (d) none of these



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11. If $f(a,b) = \frac{f(b) - f(a)}{b - a}$ and

$f(a, b, c) = \frac{f(b, c) - f(a, b)}{c - a}$ prove that

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



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12. Let m be a positive integer and $\Delta r = \begin{vmatrix} 2r - 1 & .^m C_r & 1 \\ m^2 - 1 & 2^m & m + 1 \\ \sin^2(m^2) & \sin^2 m & \sin(m^2) \end{vmatrix}$.

Then the value of $\sum_{r=0}^m \Delta r$



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13. If $\text{Delta}_r = |2^{r-1}2 \cdot 3^{r-1}4 \cdot 5^{r-1}xyz2^n - 13^n - 15^n - 1|$. Show that

$$\sum_{r=1}^n \text{Delta}_r = \text{Constant}$$



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14. The value of $\sum_{r=2}^n (-2)^r \begin{vmatrix} n - 2C_{r-2} & n - 2C_{r-1} & n - 2C_r \\ -3 & 1 & 1 \\ 2 & -1 & 0 \end{vmatrix}$ ($n > 2$)



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15.

Prove

that

$$|a_1\alpha_1 + b_1\beta_1a_1\alpha_2 + b_2\beta_2a_1\alpha_3 + b_1\beta_3a_2\alpha_1 + b_2\beta_1a_2\alpha_2 + b_2\beta_2a_2\alpha_3 + b_2\beta_3a_3\alpha_1|$$



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16. . For what values of λ and μ the system of equations

$x + y + z = 6, x + 2y + 3z = 10, x + 2y + \lambda z = \mu$ has (i) Unique solution (ii) No solution (iii) Infinite number of solutions



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17. If $bc + qr = ca + rp = ab + pq = -1$ and $(abc, pqr \neq 0)$ then

$$\begin{vmatrix} ap & a & p \\ bq & b & q \\ cr & c & r \end{vmatrix}$$
 is (A) 1 (B) 2 (C) 0 (D) 3



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18.

Given

$a = x/(y - z)$, $b = y/(z - x)$, and $c = z/(x - y)$, where x, y, z and z are not all zero, then the value of $ab + bc + ca$ is
0 b. 1 c. -1 d. none of these



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19. Consider the system linear equations in x, y , and z given by

$$(s \in 3\theta)x - y + z = 0, (\cos 2\theta)x + 4y + 3z = 0, 2x + 7y + 7z = 0.$$

Find the value of θ for which the system has a non-trivial solution.



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20. If the system of equations,

$$x + 2y - 3z = 1, (k + 3)z = 3, (2k + 1)x + z = 0$$
 is inconsistent, then the value of k is (A) -3 (B) $\frac{1}{2}$ (C) 0 (D) 2



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21. The value of the determinant $\begin{vmatrix} x & x+a & x+2a \\ x & x+2a & x+4a \\ x & x+3a & x+6a \end{vmatrix}$ is (A) 0 (B) $a^3 - x^3$ (C) $x^3 - a^3$ (D) $(x-a)^3$



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22. Value of the determinant $\begin{vmatrix} x & 1 & 1 \\ 0 & 1+x & 1 \\ -y & 1+x & 1+y \end{vmatrix}$ is (A) xy (B) $xy(x+2)$ (C) $x(x+1)(y+1)$ (D) $xy(x+1)$



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23. If each element of a third order determinant of value λ is multiplied by 5 then value of the new determinant is (A) 125λ (B) 25λ (C) 5λ (D) λ



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24. In a third order determinant, each element of the first column consists of sum of two terms, each element of the second column consists of sum of three terms and each element of the third column consists of sum of four terms, Then it can be decomposed into four terms,.Then it can be decomposed into n determinants, where n has value



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25. A root of the equation

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



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26. Three linear equations
 $a_1x + b_1y + c_1z = 0, a_2x + b_2y + c_2z = 0, a_3x + b_3y + c_3z = 0$ are consistent if (A) $\begin{vmatrix} a_1 & b_1 & c_1 \\ a_2 & b_2 & c_2 \\ a_3 & b_3 & c_3 \end{vmatrix} = 0$ (B)
$$\begin{vmatrix} a_1 & b_1 & c_1 \\ a_2 & b_2 & c_2 \\ a_3 & b_3 & c_3 \end{vmatrix} = -1(C)a_1b_1c_1 + a_2b_2c_2 + a_3b_3c_3 = 0$$
 (D) none of these



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27. $\begin{vmatrix} a_1 & b_1 & c_1 \\ a_2 & b_2 & c_2 \\ a_3 & b_3 & c_3 \end{vmatrix} = 0$ then the system of equations $a_1x + b_1y + c_1z = 0, a_2x + b_2y + c_2z = 0, a_3x + b_3y + c_3z = 0$ has (A) no solution (B) one trivial and one non trivial solutions (C) only the trivial solution (0,0,0) (D) more than two solution



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28. If the value of a third order determinant is 11 then the value of the square of the determinant formed by the cofactors will be



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29. Let $f(x) = |x^3 \sin x \cos x - 10pp^2p^3|$, where p is a constant. Then $\frac{d^3}{dx^3}(f(x))$ at $x = 0$ is (a) $p - p^3$ (b) $p + p^3$ (c) independent of p



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30.

If

$$f(x) = |(1, x, x + 1), (2x, x(x - 1), (x + 1)x, 3x(x - 1), x(x - 1)(x - 2)|$$

is equal to (A) 0 (B) 1 (C) 100 (D) -100

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31. If the system of equations

 $x - ky - z = 0, kx - y - z = 0, x + y - z = 0$ has a nonzero solution,then the possible value of k are -1, 2 b. 1, 2 c. 0, 1 d. -1, 1[Watch Video Solution](#)

32. The number of solution of the following equations

$$x_2 - x_3 = 1, -x_1 + 2x_3 = -2, x_4 - 2x_2 = 3$$
 is

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33.
$$\begin{vmatrix} b^2c^2 & bc & b+c \\ c^2a^2 & ca & c+a \\ a^2b^2 & ab & a+b \end{vmatrix} = 0$$



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34. The number of distinct real roots of $|s \in x \cos x \cos x \cos x \cos x s \in x \cos x \cos x \cos x s \in x| = 0$ in the interval $-\frac{\pi}{4} \leq x \leq \frac{\pi}{4}$ is 0 b. 2 c. 1 d. 3



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35. The value of the determinant $\begin{vmatrix} 1 & a & a^2 - bc \\ 1 & b & b^2 - ca \\ 1 & c & c^2 - ab \end{vmatrix}$ is (A) $(a + b + c), (a^2 + b^2 + c^2)$ (B) $a^3 + b^3 + c^3 - 3abc$ (C) $(a - b)(b - c)(c - a)$ (D) 0



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36. One root of the equation $\begin{vmatrix} 3x - 8 & 3 & 3 \\ 3 & 3x - 8 & 3 \\ 3 & 3 & 3x - 8 \end{vmatrix} = 0$ is (A) 8/3
(B) 2/3 (C) 1/3 (D) 16/3



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37. If $r = |2^r 2 \cdot 3^r - 14 \cdot 5^r - 1| \alpha \beta \gamma 2^n - 13^n - 15^n - 1|$, then find the value of .

A. 0

B. alpha beta gamma

C. alpha+beta+gamma

D. `alpha.2^n+beta.3^n+gamma.5^n

Answer: null



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38. If l, m, n are the p th, q th, r th terms respectively of a G.P.

$(l, m, n > 0) \text{ then } \begin{vmatrix} \log l & p & 1 \\ \log m & 1 & 1 \\ \log n & r & 1 \end{vmatrix} =$

(A) pqr (B) $l + m + n$ (C) 0 (D) none of these



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39. The three roots of the equation $\begin{vmatrix} x & 3 & 7 \\ 2 & x & 2 \\ 7 & 6 & x \end{vmatrix}$ are



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40. The value of the determinant $|kak^2 + a^2 1kbk^2 + b^2 1kck^2 + c^2 1|$ is
 $k(a + b)(b + c)(c + a)$ $kabc(a^2 + b^2 + c^2)$ $k(a - b)(b - c)(c - a)$
 $k(a + b - c)(b + c - a)(c + a - b)$



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41. The value of the determinant $\Delta = \begin{vmatrix} 1 & 1 & 1 \\ a & b & c \\ a^3 & b^3 & c^3 \end{vmatrix}$ is (A) $(a - b)(b - c)(c - a)(a + b + c)$ (B) $abc(a + b)(b + C)(c + a)$ (C) $(a - b)(b - c)(c - a)$ (D) none of these



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42. If a, b, c are unequal then what is the condition that the value of the following determinant is zero $\Delta = \begin{vmatrix} a & a^2 & a^3 + 1 \\ b & b^2 & b^3 + 1 \\ c & c^2 & c^3 + 1 \end{vmatrix}$



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



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44. If $p(x)$, $q(x)$ and $r(x)$ are three polynomials of degree 2, then prove

that $\begin{vmatrix} p(x) & q(x) & r(x) \\ p'(x) & q'(x) & r'(x) \\ p''(x) & q''(x) & r''(x) \end{vmatrix}$ is independent of x .



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45. If $a_1, a_2, a_3, \dots, a_{12}$ are in A.P. and

$$\Delta_1 = \begin{vmatrix} a_1a_5 & a_1 & a_2 \\ a_2a_6 & a_2 & a_3 \\ a_3a_7 & a_3 & a_4 \end{vmatrix}, \quad \begin{vmatrix} a_2a_{10} & a_2 & a_3 \\ a_3a_{11} & a_3 & a_4 \\ a_4 - 12 & a_4 & a_5 \end{vmatrix} \text{ then } \Delta_1 : \Delta_2 =$$

(A) 1:2

(B) 2:1

(C) 1:1

(D) none of these



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46. If $\begin{vmatrix} x & -2 & 10 \\ -2 & x & 10 \\ 10 & -2 & x \end{vmatrix} = 0$ then (A) $x = 7$ (B) $x = -4$ (C) $x = -8$ (D)

$x = 0$



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47.

If

$$|x^n x^{n+2} x^{n+4} y^n y^{n+2} y^{n+4} z^n z^{n+2} z^{n+4}| = \left(\frac{1}{y^2} - \frac{1}{x^2}\right) \left(\frac{1}{z^2} - \frac{1}{y^2}\right) \left(\frac{1}{x^2} - \frac{1}{z^2}\right)$$

then n is _____.



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48. If ω is a cube root of unity, then $\begin{vmatrix} 1-i & \omega^2 & -\omega \\ \omega^2+i & \omega & -i \\ 1-2i-\omega^2 & \omega^2-\omega & i-\omega \end{vmatrix} =$ (A)

-1 (B) i (C) ω (D) 0



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49. The equation $\begin{vmatrix} x-a & x-b & x-c \\ x-b & x-a & x-c \\ x-c & x-b & x-a \end{vmatrix} = 0$ (a,b,c are different) is satisfied by (A) $x = (a+b+c)/3$ (B) $x = \frac{1}{3}(a+b+c)$ (C) $x = 0$ (D) none of these



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50. For the system of equations $x + y + z = 4$, $y + 2z = 5$ and $x + y + pz = q$ to have no solution (A) $p = 1$ and $q = 4$ (B) $p = 1$ and $q \neq 4$ (C) $p \neq 1$ and $q = 4$ (D) $p \neq 1$ and $q \neq 4$



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51. If $= |abcb^2 \wedge 2bab \wedge 2aca^2 abca^2 \wedge 2a| = 0$, ($a, b, c \in R$ and are all different and nonzero), then prove that $a + b + c = 0$.



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52.

If

$(1 + ax + bx^2) = a_0 + a_1x + a_2x^2 + \dots + a_8x^8$, where $a, b, a_0, a_1, \dots, a_8 \in R$ such that $a_0 + a_1 + a_2 \neq 0$ and $|a_0a_1a_2a_1a_2a_0a_2a_0a_1| = 0$, then the value of $5\frac{a}{b}$ is _____.



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53. If a, b, c be the p th, q th and r th terms respectively of a H.P., then

$$\begin{vmatrix} bc & p & 1 \\ ca & q & 1 \\ ab & r & 1 \end{vmatrix} = \text{(A) } 0 \text{ (B) } 1 \text{ (C) } -1 \text{ (D) none of these}$$



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54. The determinant $D = \begin{vmatrix} \cos(\alpha + \beta) & -\sin(\alpha + \beta) & \cos 2\beta \\ \sin \alpha & \cos \alpha & \sin \beta \\ -\cos \alpha & \sin \alpha & \cos \beta \end{vmatrix}$ is independent of :-



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55. If $a_1, a_2, a_3, \dots, a_n, \dots$ are in G.P. then the determinant

$$\Delta = \begin{vmatrix} \log a_n, \log a_{n+1}, \log a_{n+2} \\ \log a_{n+3}, \log a_{n+4}, \log a_{n+5} \\ \log a_{n+6}, \log a_{n+7}, \log a_{n+8} \end{vmatrix}$$
 is equal to- (A) -2 (B) 1 (C) -1 (D) 0



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56.

If

$$|x + yx + y + z2x3x + 2y4x + 3y + 2z3x6x + 3y10x + 6y + 3z| = 64,$$

then the real value of x is _____.



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57. Given $A = |ab2cde2flm2n|$, $B = |f2de2n4l2mc2ab|$, then the value

of B/A is _____.



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58. If x, y, z are distinct and $\begin{vmatrix} x & x(x^2 + 1) & x + 1 \\ y & y(y^2 + 1) & y + 1 \\ z & z(z^2 + 1) & z + 1 \end{vmatrix} = 0$ then (A) $xyz = 0$
(B) $x + y + z = 0$ (C) $xy + yz + zx = 0$ (D) $x^2 + y^2 + z^2 = 1$



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59. $\begin{vmatrix} ax + y & x & y \\ ay + 1 & y & 1 \\ 0 & ax + y & ay + 1 \end{vmatrix} = 0$ where $a^2x + 2ay + 1 \neq 0$ represents

(A) a straight line (B) a circle (C) a parabola (D) none of these



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60. Let a, b, c be such that $b(a + c) \neq 0$. If
 $|aa + 1a - 1 - + 1b - 1 - 1c + 1| + |a + 1b + 1c - 1a - 1b - 1c + 1| -$
then the value of n is (1) zero (2) any even integer (3) any odd integer (4)
any integer



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61. If $\alpha_r = (\cos 2r\pi + i \sin 2r\pi)^{\frac{1}{10}}$, then $\begin{vmatrix} \alpha_1 & \alpha_2 & \alpha_4 \\ \alpha_2 & \alpha_3 & \alpha_5 \\ \alpha_3 & \alpha_4 & \alpha_6 \end{vmatrix} =$ (A) α_5 (B) α_7
(C) 0 (D) none of these



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62. If $f(x) = \tan x$ and A, B, C are the angles of $\triangle ABC$, then $|f(A), f(\pi/4), f(\pi/4)), (f(\pi/4), f(B) f(\pi/4)), (f(\pi/4), f(\pi/4) f(C))| =$ (A) 0 (B) -2 (C) 2
(D) 1



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63. If $a \neq 1, b \neq 1, c \neq 1, f(x) = \frac{1}{1-x}$ and $\begin{vmatrix} a & 1 & 1 \\ 1 & b & 1 \\ 1 & 1 & c \end{vmatrix} = 0$ then (A)
 $f(a) + f(b) + f(c) = 0$ (B) $f(a) + f(b) + f(c) = 1$ (C)
 $f(a) + f(b) + f(c) = -1$ (D) $f(a)f(b)f(c) = 1$



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64. $a \neq p, b \neq q, c \neq r$ 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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65. Prove that : $\begin{vmatrix} 0 & a-b & a-c \\ b-a & 0 & b-c \\ c-a & c-b & 0 \end{vmatrix} = 0$



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66. If $a, b, c, d > 0, x \in R$ and

$$(a^2 + b^2 + c^2)x^2 - 2(ab + bc + cd)x + b^2 + c^2 + d^2 \leq 0 \quad \text{then,}$$

$$\begin{vmatrix} 1 & 1 & \log a \\ 1 & 2 & \log b \\ 1 & 3 & \log c \end{vmatrix} =$$



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67. If $\sum_{n=1}^n u_n = an^2 + bn + c$, then $\begin{vmatrix} u_1 & u_2 & u_3 \\ 1 & 1 & 1 \\ 7 & 8 & 9 \end{vmatrix} =$ (A) 0 (B)

$u_1 - u_2 + u_3$ (C) 1 (D) none of these



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68. If $\sum_{n=1}^n \alpha_n = an^2 + bn$, where a, b are constants and $\alpha_1, \alpha_2, \alpha_3 \in \{12, 39\}$ and $25\alpha_{137}\alpha_2, 49\alpha_3$ be three digit number, then prove that $|\alpha_1\alpha_2\alpha_357925\alpha_137\alpha_249\alpha_3| = 0$



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69. Prove that $a \neq 0, |x + a \times \times + a \times \times + a^2| = 0$ represents a straight line parallel to the y-axis.



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70. If $f_r(x), g_r(x), h_r(x), r = 1, 2, 3$ are polynomials such that

$f_r(a) = g_r(a) = h_r(a), r = 1, 2, 3$ and

$F(x) = |f_1(x)f_2(x)f_3(x)g_1(x)g_2(x)g_3(x)h_1(x)h_2(x)h_3(x)|$ then

$F'(x)$ at $x = a$ is _____



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71. If $f(x) = \begin{vmatrix} \cos(x + \alpha) & \cos(x + \beta) & \cos(x + \gamma) \\ \sin(x + \alpha) & \sin(x + \beta) & \sin(x + \gamma) \\ \sin(\beta + \gamma) & \sin(\gamma + \alpha) & \sin(\alpha + \beta) \end{vmatrix}$ then

$f(\theta) - 2f(\phi) + f(\psi)$ is equal to



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72. $\begin{vmatrix} 2x_1y_1 & x_1y_2 + x_2y_1 & x_1y_3 + x_3y_1 \\ x_1y_2 + x_2y_1 & 2x_2y_2 & x_2y_3 + x_3y_2 \\ x_1y_3 + x_3y_1 & x_2y_3 + x_3y_2 & 2x_3y_3 \end{vmatrix} =$ (A) 0 (B) 1 (C) -1 (D)

none of these



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73.

Let

$g(x) = |(f(x + \alpha), f(x + 2\alpha), f(x + 3\alpha)), f(\alpha), f(2\alpha), f(3\alpha), (f'(\alpha))|$, where alpha is a constant then $Lt_{x \rightarrow 0} \frac{g(x)}{x} =$ (A) 0 (B) 1 (C) -1 (D) none of these



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74. $y = \begin{vmatrix} x^2 + x & x + 1 & x - 2 \\ 2x^2 + 3x + 1 & 3x & 3x - 3 \\ x^2 + 3x + 2 & 2x - 1 & 2x - 1 \end{vmatrix}$ represents (A) a straight line
(B) a circle (C) a parabola (D) none of these



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75. Let $f(x) = ax^2 + bx + c, a, b, c, \in R$ and equation $f(x) - x = 0$ has imaginary roots α, β . If r, s be the roots of $f(f(x)) - x = 0$, then

$$\begin{vmatrix} 2 & \alpha & \delta \\ \beta & 0 & \alpha \\ \gamma & \beta & 1 \end{vmatrix} \text{ is}$$



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76.

IF

$$ax^3 + bx^2 + cx + d =$$

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

, then d= (A) 1 (B) -8 (C) 0 (D) none of these



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77. The value of $\begin{vmatrix} \cos(x-a) & \cos(x+a) & \cos x \\ \sin(x+a) & \sin(x-a) & \sin x \\ \cos a \tan x & \cos a \cot x & \cot x \end{vmatrix} =$ (A) 1 (B) $\sin a \cos a$
(C) 0 (D) $\sin x \cos x$



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78. Choose any 9 distinct integers. These 9 integers can be arranged to form 9! Determinants each of order 3. Then sum of these 9! Determinants is (A) 0 (B) 3! (C) 1! 0 (D) 9!



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79. The determinant $\Delta(k) = \begin{vmatrix} a^2(a+b) & ab & ac \\ ab & b^2(a+k) & bc \\ ac & bc & c^2(1+k) \end{vmatrix}$ is

divisible by



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80. If a, b, c are in G.P. then the value of $\begin{vmatrix} a & b & a+b \\ b & c & b+c \\ a+b & b+c & 0 \end{vmatrix}$ = (A) 1 (B)

-1 (C) $a + b + c$ (D) 0



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81. If $z = \begin{vmatrix} 1+i & 5+2i & 3-2i \\ 7i & -3i & 5i \\ 1-i & 5-2i & 3+2i \end{vmatrix}$ then (A) z is purely real (B) z

is purely real (C) z has equal real and imaginary parts (D) z has positive real and imaginary parts.



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82. $\begin{vmatrix} 3 & -3i & x \\ 4 & y & i \\ 0 & 2i & -i \end{vmatrix} = 18 + 11i$ is true of (A) $x = 1, y = 2$ (B)

$x = 1, y = -1$ (C) $x = -1, y = 1$ (D) $x = 0, y = 3$



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83. If α, β and γ the roots of the equation $x^2(px + q) = r(x + 1)$. Then

the value of determinant $\begin{vmatrix} 1 + \alpha & 1 & 1 \\ 1 & 1 + \beta & 1 \\ 1 & 1 & 1 + \gamma \end{vmatrix}$ is (A) $\alpha\beta\gamma$ (b)

$1 + \frac{1}{\alpha} + \frac{1}{\beta} + \frac{1}{\gamma}$ (c) 0 (d) non of these



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84. If $\theta \in \left(0, \frac{\pi}{2}\right)$ then the value of

$$\begin{vmatrix} (\sin \theta + \cos e\theta)^2 & (\sin \theta - \cos e\theta)^2 & 1 \\ (\cos \theta + \sec \theta)^2 & (\cos \theta - \sec \theta)^2 & 1 \\ (\tan \theta + \cot \theta)^2 & (\tan \theta - \cot \theta)^2 & 1 \end{vmatrix} = \text{(A) } \sin \theta + \cos \theta + \tan \theta$$

(B) 1 (C) 0 (D) 4



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85. If $y = \sin \theta + \sqrt{3} \cos \theta$ and $\begin{vmatrix} 1+y & 1-y & 1-y \\ 1-y & 1+y & 1-y \\ 1-y & 1-y & 1+y \end{vmatrix} = 0$ the number of solution in $[0, 2\pi]$ is (A) one (B) two (C) three (D) none of these



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86. The value of the determinant $\left| \left((a^x + a^{-x})^2 (a^x - a^{-x})^2 1 \right) \left((b^x + b^{-x})^2 (b^x - b^{-x})^2 1 \right) \left((c^x + c^{-x})^2 (c^x - c^{-x})^2 1 \right) \right|$ (A) is 0 (B) is independent of a (C) depends on b only (D) depends on a,b, and c



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87. The value of the determinant $\begin{vmatrix} b+c & a & a \\ b & c+a & b \\ c & c & a+b \end{vmatrix}$ (A) depends on a
(B) depends on b (C) depends on c (D) dependent of a,b,c



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88. If $\Delta_1 = |xaxbaax|$ and $\Delta_2 = |xbax|$ are the given determinants, then $\Delta_1 = 3(\Delta_2)^2$ b. $\frac{d}{dx}(\Delta_1) = 3\Delta_2$ c. $\frac{d}{dx}(\Delta_1) = 3(\Delta_2)^2$ d. $\Delta_1 = 3\Delta_2^3/2$



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89. Let a, b and c denote the sides BC, CA and AB respectively of ABC . If $|1ab1ca1bc| = 0$



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90.
$$\begin{vmatrix} b^2c^2 & bc & b+c \\ c^2a^2 & ca & c+a \\ a^2b^2 & ab & a+b \end{vmatrix} = 0$$



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91.

If

$$f(x) = |(1, x, x+1), (2x, x(x-1), x(x+1)), (3x(x-1), x(x-1)(x+1))|$$

then (A) $f(x)$ is a polynomial of degree 4 (B) $f(x)$ is an odd function (C)

$f(x)$ is a constant function (D) $f(x)$ is an even function



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92. If $px^4 + qx^3 + rx^2 + sx + t = \begin{vmatrix} x^2 + 3x & x - 1 & x + 3 \\ x + 1 & 2 - x & x - 3 \\ x - 3 & x + 4 & 3x \end{vmatrix}$ then t is

equal to



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93. if $f(x) = \begin{vmatrix} x - 3 & 2x^2 - 18 & 3x^3 - 81 \\ x - 5 & 2x^2 - 50 & 4x^3 - 500 \\ 1 & 2 & 3 \end{vmatrix}$ then

$f(1)f(3) + f(3)f(5) + f(5)f(1)$ is equal to



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94. Given $A = |ab^2cde^2f^lm^2n|$, $B = |f^2de^2n^4l^2mc^2ab|$, then the value of B/A is _____.



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95. Let $\Delta = \begin{vmatrix} n & n+1 & n+2 \\ n+1 & n+2 & n+3 \\ n+2 & n+3 & n+4 \end{vmatrix}$ then (A)

$\Delta = [n][n+1][n+2]$ (B) $\Delta = 2[n][n+1][n+2]$ (C) $\frac{\Delta}{(|n|)^3} - 4$ is divisible by n (D) $\frac{\Delta}{(|n|)^3} - 4$ is divisible by n^2



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96. The determinant $\begin{vmatrix} C(x, 1) & C(x, 2) & C(x, 3) \\ C(y, 1) & C(y, 2) & C(y, 3) \\ C(z, 1) & C(z, 2) & C(z, 3) \end{vmatrix} =$ (i)

$\frac{1}{3}xyz(x+y)(y+z)(z+x)$ (ii) $\frac{1}{4}xyz(x+y-z)(y+z-x)$ (iii)

$\frac{1}{12}xyz(x-y)(y-z)(z-x)$ (iv) none



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97. The value of the determinant $\begin{vmatrix} 1+a & 1 & 1 \\ 1 & 1+a & 1 \\ 1 & 1 & 1+a \end{vmatrix}$ is zero if (A)

- (A) $a = -3$ (B) $a = 0$ (C) $a = 2$ (D) $a = 1$



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98. The determinant $|aba\alpha + cba\alpha + ca\alpha + \alpha + c0| = 0$, if a, b, c are in A.P. a, b, c are in G.P. a, b, c are in H.P. α is a root of the equation $ax^2 + bx + c = 0$ ($x - \alpha$) is a factor of $ax^2 + 2bx + c$



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99. The value of α for which the system of equations $x + y + z = 1$, $x + 2y + 4z = \alpha$, $x + 4y + 10z = \alpha^2$ has no solution is (A) -1 (B) 0 (C) 3 (D) 2



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100. If α, β and γ are such that $\alpha + \beta + \gamma = 0$, then

$$\begin{vmatrix} 1 & \cos \gamma & \cos \beta \\ \cos \gamma & 1 & \cos \alpha \\ \cos \beta & \cos \alpha & 1 \end{vmatrix}$$



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101. If $p(x), q(x), r(x)$ be polynomials of degree one and α, β, γ are real

nubers then $\begin{vmatrix} p(\alpha) & p(\beta) & p(\gamma) \\ q(\alpha) & q(\beta) & q(\gamma) \\ r(\alpha) & r(\beta) & r(\gamma) \end{vmatrix}$ (A) independent of α (B) independent of β (C) independent γ (D) independent of all α, β and γ



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102. If $f(x)$ and $g(x)$ are functions such that

$f(x + y) = f(x)g(y) + g(x)f(y)$, then in $\begin{vmatrix} f(\alpha) & g(\alpha) & f(\alpha + \theta) \\ f(\beta) & g(\beta) & f(\beta + \theta) \\ f(\lambda) & g(\lambda) & f(\lambda + \theta) \end{vmatrix}$ is

independent of



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103. Let a, b, c be even natural numbers, then $\Delta = \begin{vmatrix} a-x & a & a+x \\ b-x & b & b+x \\ c-x & c & c+x \end{vmatrix}$ is

a multiple of (A) 2 (B) 5 (C) 3 (D) none of these



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104. Consider the following system if equations

$a_1x + b_1y + c_1z = d_1, a_2x + b_2y + c_2z = d_2, a_3x + b_3y + c_3z = d_3$ Let

$$\Delta = \begin{vmatrix} a_1 & b_1 & c_1 \\ a_2 & b_2 & c_2 \\ a_3 & b_3 & c_3 \end{vmatrix}, \Delta_1 = \begin{vmatrix} d_1 & b_1 & c_1 \\ d_2 & b_2 & c_2 \\ d_3 & b_3 & c_3 \end{vmatrix}, \Delta_2 = \begin{vmatrix} a_1 & d_1 & c_1 \\ a_2 & d_2 & c_2 \\ a_3 & d_3 & c_3 \end{vmatrix}, \Delta_3 =$$

The given system of equations will have i. unique solution of $\Delta \neq 0$ ii.

infinitely many solutions if

$\Delta = \Delta_1 = \Delta_3 = 0$. iii. no solution if $\Delta = 0$ and any of 1, 2, 3

is not zero. On the basis of above information answer the following questions

$$2x+ay+6z=8, \quad x+2y+bz=5, \quad x+y+3z=4$$

The given system of equations has a unique solution if (A) $a=2, b=2$ (B)

$a=2, b=3$ (C) $a=2, b=3$ (D) $a=2, b=3$

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105. Consider the following system if equations

$$a_1x + b_1y + c_1z = d_1, a_2x + b_2y + c_2z = d_2, a_3x + b_3y + c_3z = d_3 \text{ Let}$$

$$\Delta = \begin{vmatrix} a_1 & b_1 & c_1 \\ a_2 & b_2 & c_2 \\ a_3 & b_3 & c_3 \end{vmatrix}, \Delta_1 = \begin{vmatrix} d_1 & b_1 & c_1 \\ d_2 & b_2 & c_2 \\ d_3 & b_3 & c_3 \end{vmatrix}, \Delta_2 = \begin{vmatrix} a_1 & d_1 & c_1 \\ a_2 & d_2 & c_2 \\ a_3 & d_3 & c_3 \end{vmatrix}, \Delta_3 =$$

The given system of equations will have i. unique solution of $\Delta \neq 0$ ii.

infinitely many solutions if $\Delta = \Delta_1 = \Delta_3 = 0$. iii. no solution if

$\Delta \neq 0$ and any of $\Delta_1, \Delta_2, \Delta_3$ is none zero. On the basis of above

information answer the following questions for the following system of

$$2x + ay + 6z = 8, x + 2y + bz = 5, x + y + 3z = 4$$

The given system of equation has unique solution if (A) $a = 2, b = 2$ (B)

$a \neq 2, b = 3$ (C) $a \neq 2, b \neq 3$ (D) $a = 2, b \neq 3$



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106. Consider the following system if equations

$$a_1x + b_1y + c_1z = d_1, a_2x + b_2y + c_2z = d_2, a_3x + b_3y + c_3z = d_3 \text{ Let}$$

$$\Delta = \begin{vmatrix} a_1 & b_1 & c_1 \\ a_2 & b_2 & c_2 \\ a_3 & b_3 & c_3 \end{vmatrix}, \Delta_1 = \begin{vmatrix} d_1 & b_1 & c_1 \\ d_2 & b_2 & c_2 \\ d_3 & b_3 & c_3 \end{vmatrix}, \Delta_2 = \begin{vmatrix} a_1 & d_1 & c_1 \\ a_2 & d_2 & c_2 \\ a_3 & d_3 & c_3 \end{vmatrix}, \Delta_3 =$$

The given system of equations will have i. unique solution of $\Delta \neq 0$ ii.

infinitely many solutions if $\Delta = \Delta_1 = \Delta_3 = 0$. iii. no solution if

$\Delta = 0$ and *anyof* $\Delta_1, \Delta_2, \Delta_3$ is none zero. On the basis of above

informatioin answer the following questions for the following system of

linear equations. $2x + ay + 6z = 8, x + 2y + bz = 5, x + y + 3z = 4$

The given system of equatioin has infinitely many solution if (A)

- (a) $a \neq 2, b \neq 3$ (B) $a \neq 2, b = 3$ (C) $a=2, b \in R$ (D) $a \neq 2, b \in R$



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107. Consider the following system if equations

$a_1x + b_1y + c_1z = d_1, a_2x + b_2y + c_2z = d_2, a_3x + b_3y + c_3z = d_3$ Let

$$\Delta = \begin{vmatrix} a_1 & b_1 & c_1 \\ a_2 & b_2 & c_2 \\ a_3 & b_3 & c_3 \end{vmatrix}, \Delta_1 = \begin{vmatrix} d_1 & b_1 & c_1 \\ d_2 & b_2 & c_2 \\ d_3 & b_3 & c_3 \end{vmatrix}, \Delta_2 = \begin{vmatrix} a_1 & d_1 & c_1 \\ a_2 & d_2 & c_2 \\ a_3 & d_3 & c_3 \end{vmatrix}, \Delta_3 =$$

The given system of equations will have i. unique solution of $\Delta \neq 0$ ii.

infinitely many solutions if

- $\Delta = \Delta_1 = \Delta_3 = 0$. iii. no solution if $\Delta = 0$ and *anyof* / _1,

/_2,

/_3

is no \neq zero \odot On the basis of above $\in f$ or matio \in answer the follow $\in gq$

$$2x+ay+6z=8,$$

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

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

The given system of equatio \in has unique solution if (A)a=2,b=2(B)

a!=2,b=3(C)a!=2, b!=3(D)a=2,b!=3`



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108. Consider the following system of equations

$a_1x + b_1y + c_1z = d_1, a_2x + b_2y + c_2z = d_2, a_3x + b_3y + c_3z = d_3$ Let

$$\Delta = \begin{vmatrix} a_1 & b_1 & c_1 \\ a_2 & b_2 & c_2 \\ a_3 & b_3 & c_3 \end{vmatrix}, \Delta_1 = \begin{vmatrix} d_1 & b_1 & c_1 \\ d_2 & b_2 & c_2 \\ d_3 & b_3 & c_3 \end{vmatrix}, \Delta_2 = \begin{vmatrix} a_1 & d_1 & c_1 \\ a_2 & d_2 & c_2 \\ a_3 & d_3 & c_3 \end{vmatrix}, \Delta_3 =$$

The given system of equations will have i. unique solution of $/_!\!=0$ ii.

infinitely many solutions if

$\Delta = \Delta_1 = \Delta_3 = 0$. iii. no solution if $\Delta = 0$ and any of Δ_1, Δ_2

is none zero. On the basis of above information answer the following

questions for the following system of linear equations.

$x + y + z = 6, x + 2y + 3z = 14, 2x + 5y + \lambda = \mu$ The given system

of equations has infinitely many solution if (A) $\lambda = 7, \mu = 36$ (B)

$\lambda \neq 8, \mu = 36$ (C) $\lambda = 8, \mu = 36$ (D) $\lambda \neq 8, \mu \neq 36$



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109. Consider the following system of equations

$a_1x + b_1y + c_1z = d_1, a_2x + b_2y + c_2z = d_2, a_3x + b_3y + c_3z = d_3$ Let

$$\Delta = \begin{vmatrix} a_1 & b_1 & c_1 \\ a_2 & b_2 & c_2 \\ a_3 & b_3 & c_3 \end{vmatrix}, \Delta_1 = \begin{vmatrix} d_1 & b_1 & c_1 \\ d_2 & b_2 & c_2 \\ d_3 & b_3 & c_3 \end{vmatrix}, \Delta_2 = \begin{vmatrix} a_1 & d_1 & c_1 \\ a_2 & d_2 & c_2 \\ a_3 & d_3 & c_3 \end{vmatrix}, \Delta_3 =$$

The given system of equations will have i. unique solution of $\Delta \neq 0$ ii.

infinitely many solutions if

$\Delta = \Delta_1 = \Delta_3 = 0$. iii. no solution if $\Delta = 0$ and any of $\Delta_1, \Delta_2, \Delta_3$

is not zero. On the basis of above information answer the following questions

$$x+y+z=6, \quad x+2y+3z=14, \quad 2x+5y+\lambda=\mu$$

The given system of equations has no solution if (A) $\lambda=3, \mu=10$

(B) $\lambda \neq 3, \mu \neq 10$ (C) $\lambda=3, \mu \neq 10$ (D) $\lambda \neq 3, \mu=10$



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110. Consider the following system of equations

$a_1x + b_1y + c_1z = d_1, a_2x + b_2y + c_2z = d_2, a_3x + b_3y + c_3z = d_3$ Let

$$\Delta = \begin{vmatrix} a_1 & b_1 & c_1 \\ a_2 & b_2 & c_2 \\ a_3 & b_3 & c_3 \end{vmatrix}, \Delta_1 = \begin{vmatrix} d_1 & b_1 & c_1 \\ d_2 & b_2 & c_2 \\ d_3 & b_3 & c_3 \end{vmatrix}, \Delta_2 = \begin{vmatrix} a_1 & d_1 & c_1 \\ a_2 & d_2 & c_2 \\ a_3 & d_3 & c_3 \end{vmatrix}, \Delta_3 =$$

, The given system of equations will have i. unique solution of $\Delta \neq 0$ ii.

infinitely many solutions if

$\Delta = \Delta_1 = \Delta_3 = 0$. iii. no solution if $\Delta \neq 0$ and any of Δ_1, Δ_2

is none zero. On the basis of above information answer the following

questions for the following system of linear equations.

$x + y + z = 6, x + 2y + 3z = 14, 2x + 5y + \lambda = \mu$ The given system of equations has no solution if

(A) $\lambda = 8, \mu = 36$ (B) $\lambda \neq 8, \mu \neq 36$ (C) $\lambda = 8, \mu \neq 36$ (D) $\lambda \neq 8, \mu \neq 36$



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111. Consider the following system of equations

$a_1x + b_1y + c_1z = d_1, a_2x + b_2y + c_2z = d_2, a_3x + b_3y + c_3z = d_3$ Let

$$\Delta = \begin{vmatrix} a_1 & b_1 & c_1 \\ a_2 & b_2 & c_2 \\ a_3 & b_3 & c_3 \end{vmatrix}, \Delta_1 = \begin{vmatrix} d_1 & b_1 & c_1 \\ d_2 & b_2 & c_2 \\ d_3 & b_3 & c_3 \end{vmatrix}, \Delta_2 = \begin{vmatrix} a_1 & d_1 & c_1 \\ a_2 & d_2 & c_2 \\ a_3 & d_3 & c_3 \end{vmatrix}, \Delta_3 =$$

The given system of equations will have i. unique solution of $\Delta \neq 0$ ii. infinitely many solutions if $\Delta = \Delta_1 = \Delta_3 = 0$. iii. no solution if $\Delta = 0$ and any of $\Delta_1, \Delta_2, \Delta_3$ is non-zero.

is non-zero. On the basis of above information answer the following questions for the following system of equations:

$$2x + ay + 6z = 8, \quad x + 2y + bz = 5, \quad x + y + 3z = 4$$

The given system of equations has a unique solution if (A) $a=2, b=2$ (B) $a=2, b=3$ (C) $a=2, b=3$ (D) $a=2, b=3$



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112. Consider the following system of equations

$$a_1x + b_1y + c_1z = d_1, \quad a_2x + b_2y + c_2z = d_2, \quad a_3x + b_3y + c_3z = d_3 \quad \text{Let}$$

$$\Delta = \begin{vmatrix} a_1 & b_1 & c_1 \\ a_2 & b_2 & c_2 \\ a_3 & b_3 & c_3 \end{vmatrix}, \quad \Delta_1 = \begin{vmatrix} d_1 & b_1 & c_1 \\ d_2 & b_2 & c_2 \\ d_3 & b_3 & c_3 \end{vmatrix}, \quad \Delta_2 = \begin{vmatrix} a_1 & d_1 & c_1 \\ a_2 & d_2 & c_2 \\ a_3 & d_3 & c_3 \end{vmatrix}, \quad \Delta_3 =$$

The given system of equations will have i. unique solution of $\Delta \neq 0$ ii. infinitely many solutions if $\Delta = \Delta_1 = \Delta_3 = 0$. iii. no solution if $\Delta = 0$ and any of $\Delta_1, \Delta_2, \Delta_3$ is non-zero. On the basis of above information answer the following questions for the following system of equations:

linear equations. $x + y + z = 6$, $x + 2y + 3z = 14$, $2x + 5y + \lambda z = \mu$

The given system of equations has infinitely many solution if (A)

$\lambda = 3, \mu = 10$ (B) $\lambda \neq 3, \mu = 10$ (C) $\lambda = 3, \mu \neq 0$ (D) $\lambda \neq 3, \mu \neq 10$



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113. If $A = \begin{vmatrix} a_1 & a_2 & a_3 \\ b_1 & b_2 & b_3 \\ c_1 & c_2 & c_3 \end{vmatrix}$ and $B = \begin{vmatrix} x_1 & x_2 & x_3 \\ y_1 & y_2 & y_3 \\ z_1 & z_2 & z_3 \end{vmatrix}$ then product of determinants A and B is given by $AB =$

$$\begin{vmatrix} a_1x_1 + a_2x_2 + a_3x_3 & a_1y_1 + a_2y_2 + a_3y_3 & a_1z_1 + a_2z_2 + a_3z_3 \\ b_1x_1 + b_2x_2 + b_3x_3 & b_1y_1 + b_2y_2 + b_3y_3 & b_1z_1 + b_2z_2 + b_3z_3 \\ c_1x_1 + c_2x_2 + c_3x_3 & c_1y_1 + c_2y_2 + c_3y_3 & c_1z_1 + c_2z_2 + c_3z_3 \end{vmatrix} \quad \text{Now}$$

answer the following questions Value of determinant

$$\begin{vmatrix} 1 & \cos(\beta - \alpha) & \cos(\gamma - \alpha) \\ \cos(\alpha - \beta) & 1 & \cos(\gamma - \beta) \\ \cos(\alpha - \gamma) & \cos(\beta - \gamma) & 1 \end{vmatrix} \text{ is } \begin{array}{l} (A) \cos \alpha \cos \beta \cos \gamma \\ (B) 0 \\ (C) \end{array}$$

$\cos(\alpha-\beta)+\cos(\beta-\gamma)+\cos(\gamma-\alpha)$ (D) \cos

$\alpha+\cos\beta+\cos\gamma$



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114. If $l_1^2 + m_1^2 + n_1^2 = 1$ etc., and $l_1l_2 + m_1m_2 + n_1n_2 = 0$, etc. and

$$\Delta = \begin{vmatrix} l_1 & m_1 & n_1 \\ l_2 & m_2 & n_2 \\ l_3 & m_3 & n_3 \end{vmatrix} \text{ then}$$



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115. $a \neq p, b \neq q, c \neq r$ 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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116. 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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117. If $f(n) = \begin{vmatrix} n! & (n+1)! & (n+2)! \\ (n+1)! & (n+2)! & (n+3)! \\ (n+2)! & (n+3)! & (n+4)! \end{vmatrix}$ Then the value of $\frac{1}{1020}[(f(100))/(f(99))]$ is



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118. If $f(x) = \begin{vmatrix} x & 1 & 1 \\ 0 & 1+x & 1 \\ -x^2 & 1+x & 1+x \end{vmatrix}$, then $\frac{1}{10^4} f(100)$ is equal to



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119. Let $D = \begin{vmatrix} a_1 & b_1 & c_1 \\ a_2 & b_2 & c_2 \\ a_3 & b_3 & c_3 \end{vmatrix}$, $D_1 = \begin{vmatrix} a_1 + pb_1 & b_1 + qc_1 & c_1 + ra_1 \\ a_2 + pb_2 & b_2 + qc_2 & c_2 + ra_2 \\ a_3 + pb_3 & b_3 + qc_3 & c_3 + ra_3 \end{vmatrix}$, then
the value of $\frac{2010D - D_1}{D_1}$ is



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120. Assertion: $\Delta = 0$, Reason value of a determinnt is 0 when any two rows or columns are identical. (A) Both A and R are true and R is the correct explanation of A (B) Both A and R are true R is not te correct explanation of A (C) A is true but R is false. (D) A is false but R is true.



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$$121. \begin{vmatrix} xp + y & x & y \\ yp + z & y & z \\ 0 & xp + y & yp + z \end{vmatrix} = 0 \text{ if}$$



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122. The parameter on which the value of the determinant $|1aa^2\cos(p - d)x \cos px \cos(p + d)x \sin(p - d)x \sin px \sin(p + d)x|$ does not depend is a b. p c. d d. x



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123. Find the value of the determinant $|baabpqr111|$, where a, b , and c are respectively, the p th, q th, and r th terms of a harmonic progression.



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124. Suppose $f(x)$ is a function satisfying the following conditions:

$f(0) = 2, f(1) = 1$ f has a minimum value at $x = \frac{5}{2}$ For all $x, f'(x) = |2ax^2 - 12ax + b + 1 + 1 - 12(ax + b)|$ $2ax + 2b + 12ax +$ where a, b are some constants. Determine the constants a, b , and the function $f(x)$



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125. Suppose $f(x)$ is a function satisfying the following conditions:

$f(0) = 2, f(1) = 1$ f has a minimum value at $x = \frac{5}{2}$ For all $x, f'(x) = |2ax^2 - 12ax + b + 1 + 1 - 12(ax + b)|$ $2ax + 2b + 12ax +$ where a, b are some constants. Determine the constants a, b , and the function $f(x)$



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126. Suppose $f(x)$ is a function satisfying the following conditions:

$f(0) = 2, f(1) = 1$ f has a minimum value at $x = \frac{5}{2}$ For all $x, f'(x) = |2ax^2 - 12ax + b + 1| + 1 - 12(ax + b)$ $2ax + 2b + 12ax +$ where a, b are some constants. Determine the constants a, b , and the function $f(x)$



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127. If $f(x) = \begin{vmatrix} 1 & x & x+1 \\ 2x & x(x-1) & (x+1)x \\ 3x(x-1) & x(x-1)(x-2) & (x+1)x(x-1) \end{vmatrix}$, then

$f(100)$ is equal to - (i) 0 (ii) 1 (iii) 100 (iv) -100



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128. If the system of equations

$x - ky - z = 0, kx - y - z = 0, x + y - z = 0$ has a nonzero solution,

then the possible value of k are – 1, 2 b. 1, 2 c. 0, 1 d. – 1, 1



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129. Prove that all values of theta:

$$\begin{vmatrix} \sin \theta & \cos \theta & \sin 2\theta \\ \sin\left(\theta + \frac{2\pi}{3}\right) & \cos\left(\theta + \frac{2\pi}{3}\right) & \sin\left(2\theta + \frac{4\pi}{3}\right) \\ \sin\left(\theta - \frac{2\pi}{3}\right) & \cos\left(\theta - \frac{2\pi}{3}\right) & \sin\left(2\theta - \frac{4\pi}{3}\right) \end{vmatrix} = 0$$



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130. The number of distinct real roots of

$$|s \in x \cos x \cos x \cos x s \in x \cos x \cos x \cos x s \in x| = 0 \text{ in the interval}$$

$$-\frac{\pi}{4} \leq x \leq \frac{\pi}{4}$$
 is 0 b. 2 c. 1 d. 3



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131. Let a, b, c be real numbers with $a^2 + b^2 + c^2 = 1$. Show that the

equation
$$\begin{vmatrix} ax - by - c & bx + ay & cx + a \\ bx + ay & -ax + by - c & cy + b \\ cx + a & cy + b & -ax - by + c \end{vmatrix} = 0$$
 represents

a straight line.



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132. If the system of equations $x + ay = 0$, $az + y = 0$ and $ax + z = 0$

has infinite solutions, then the value of a is (a) -1 (b) 1 (c) 0 (d) no real values



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133. Given, $2x - y + 2z = 2$, $x - 2y + z = -4$, $x + y + \lambda z = 4$, then

the value of λ such that the given system of equations has no solution, is



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