



MATHS

BOOKS - VK JAISWAL MATHS (HINGLISH)

DETERMINANTS

Exercise 1 Single Choice Problems

1. If $\begin{vmatrix} 1 & \cos \alpha & \cos \beta \\ \cos \alpha & 1 & \cos \gamma \\ \cos \beta & \cos \gamma & 1 \end{vmatrix} = \begin{vmatrix} 0 & \cos \alpha & \cos \beta \\ \cos \alpha & 0 & \cos \gamma \\ \cos \beta & \cos \gamma & 0 \end{vmatrix}$ then the value of $\cos^2 \alpha + \cos^2 \beta + \cos^2 \gamma$ is :

A. 1

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

C. $\frac{3}{8}$

D. $\frac{9}{4}$

Answer: A



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2. Let the following system of equations

$$kx + y + z = 1$$

$$x + ky + z = k$$

$$x + y + kz = k^2$$

has no solution . Find $|k|$.

A. 0

B. 1

C. 2

D. 3

Answer: C



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3. If $\begin{vmatrix} a & a^2 & 1 + a^3 \\ b & b^2 & 1 + b^3 \\ c & c^2 & 1 + c^3 \end{vmatrix} = 0$ and vectors $(1, a, a^2)$, $(1, b, b^2)$ and $(1, c, c^2)$

are non coplanar then the product abc equals (A) 2 (B) -1 (C) 1 (D) 0

A. 2

B. -1

C. 1

D. 0

Answer: B



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4. If the system of linear equations

$$x + 2ay + az = 0$$

$$x + 3by + bz = 0$$

$$x + 4cy + cz = 0$$

has a non-zero solution, then a, b, c

A. are in A.P.

B. are in G.P.

C. are in H.P.

D. satisfy $a+2b+3c=0$

Answer: C

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5. if the number of quadratic polynomials $ax^2 + 2bx + c$ which satisfy the following conditions :

(i) a, b, c are distinct

(ii) $a, b, c \in \{1, 2, 3, \dots, 2001, 2002\}$

(iii) $x+1$ divides $ax^2 + 2bx + c$ is equal to 1000λ , then find the value of λ .

A. 2002

B. 2001

C. 2003

D. 2004

Answer: A



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6. If the system of equations $2x+ay+6z=8$, $x+2y+z=5$, $2x+ay+3z=4$ has a unique solution then 'a' cannot be equal to :

A. 2

B. 3

C. 4

D. 5

Answer: C



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7. If one root of the equation $\begin{vmatrix} 7 & 6 & x^2 - 13 \\ 2 & x^2 - 13 & 2 \\ x^2 - 13 & 3 & 7 \end{vmatrix} = 0$ is

$x = 2$, the sum of all other five roots is

- A. -2
- B. 0
- C. $2\sqrt{3}$
- D. $\sqrt{15}$

Answer: A

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8. The system of equations

$$kx + (k + 1)y + (k - 1)z = 0$$

$$(k + 1)x + ky + (k + 2)z = 0$$

$$(k - 1)x + (k + 2)y + kz = 0$$

has a nontrivial solution for :

- A. Exactly three real value of k

B. Exactly two real values of k

C. Exactly one real value of k

D. Infinite number of values of k

Answer: C



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9. If $a_1, a_2, a_3, \dots, a_n$ are in G.P. are in $a_i > 0$ for each i , then the determinant

$$\Delta = \begin{vmatrix} \log a_n, \log a_{n+2}, \log a_{n+4} \\ \log a_{n+6}, \log a_{n+8}, \log a_{n+10} \\ \log a_{n+12}, \log a_{n+14}, \log a_{n+16} \end{vmatrix}$$

A. 0

B. $\left(\sum_{i=1}^{n^2+n} a_i \right)$

C. 1

D. 2

Answer: A



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10. if $D_1 = \begin{vmatrix} a_1 & b_1 & c_1 \\ a_2 & b_2 & c_2 \\ a_3 & b_3 & c_3 \end{vmatrix}$ and $D_2 = \begin{vmatrix} a_1 + 2a_2 + 3a_3 & 2a_3 & 5a_2 \\ b_1 + 2b_2 + 3b_3 & 2b_3 & 5b_2 \\ c_1 + 2c_2 + 3c_3 & 2c_3 & 5c_2 \end{vmatrix}$ then $\frac{D_2}{D_1}$ is equal to :

A. 10

B. -10

C. 20

D. -20

Answer: B



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11. If $\Delta_1 = \begin{vmatrix} 1 & 1 & 1 \\ a & b & c \\ a^2 & b^2 & c^2 \end{vmatrix}$ and $\Delta_2 = \begin{vmatrix} 1 & bc & a \\ 1 & ac & b \\ 1 & ab & c \end{vmatrix}$ then :-

A. $\Delta_1 = \Delta_2$

B. $\Delta_1 = 2\Delta_2$

C. $\Delta_1 + \Delta_2 = 0$

D. $\Delta_1 + 2\Delta_2 = 0$

Answer: C



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12. The value of the determinant $\begin{vmatrix} 1 & 0 & -1 \\ a & 1 & 1-a \\ b & a & 1+a-b \end{vmatrix}$ depends on :

A. only a

B. only b

C. neither a nor b

D. both a and b

Answer: C



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13. Sum of solution of the equation $\begin{vmatrix} 1 & 2 & x \\ 2 & 3 & x^2 \\ 3 & 5 & 2 \end{vmatrix} = 10$ is :

A. 1

B. -1

C. 2

D. 4

Answer: B



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14. if $D = \begin{vmatrix} x + d & x + e & x + f \\ x + d + 1 & x + e + 1 & x + f + 1 \\ x + a & x + b & x + c \end{vmatrix}$ then D does not depend

on :

A. a

B. e

C. d

D. x

Answer: D



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

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

B. $(x + y + z)(x + y + z)^2$

C. $(x + y + z)^3$

D. $(x + y + z)^2$

Answer: C



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16. A rectangle ABCD is inscribed in a circle. Let PQ be the diameter of the circle parallel the side AB. If $\angle BPC = 30^\circ$, then the ratio of the area of rectangle to the area of circle is

A. $\frac{\sqrt{3}}{x}$

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

C. $\frac{3}{\pi}$

D. $\frac{\sqrt{3}}{9\pi}$

Answer: A



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17. Let $ab = 1$, $\Delta = \begin{vmatrix} 1 + a^2 - b^2 & 2ab & -2b \\ 2ab & 1 - a^2 + b^2 & 2a \\ 2b & -2a & 1 - a^2 - b^2 \end{vmatrix}$ then the

minimum value of Δ is :

A. 3

B. 9

C. 27

D. 81

Answer: C



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18. The determinant

$$\begin{vmatrix} 2 & a + b + c + d & ab + cd \\ a + b + c + d & 2(a + b)(c + d) & ab(c + d) + cd(a + b) \\ ab + cd & ab(c + d) + cd(a + b) & 2abcd \end{vmatrix} = 0$$

for

A. $a+b+c+d=0$

B. $ab+cd=0$

C. $ab(c+d)+cd(a+b)=0$

D. any a, b, c, d

Answer: D



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19. Let $\det A = \begin{vmatrix} l & m & n \\ p & q & r \\ 1 & 1 & 1 \end{vmatrix}$ and if

$$(l - m)^2 + (p - q)^2 = 9, (m - n)^2 + (q - r)^2 = 16, (n - l)^2 + (r - p)^2 =$$

, then the value $(\det A)^2$ equals :

A. 36

B. 100

C. 144

D. 160

Answer: C



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20. The number of distinct real values of K such that the system of equations $x+2y+z=1$, $x+3y+4z=K$, $x+5y+10z = K^2$ has infinitely many solutions is :

A. 0

B. 4

C. 2

D. 3

Answer: C



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21. If $\begin{vmatrix} (x+1) & (x+1)^2 & (x+1)^3 \\ (x+2) & (x+2)^2 & (x+2)^3 \\ (x+3) & (x+3)^2 & (x+3)^3 \end{vmatrix}$ is expressed as a polynomial in x ,

then the term independent of x is :

A. 0

B. 2

C. 12

D. 16

Answer: C



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22. If A, B, C are the angles of triangle ABC , then the minimum value of

$$\begin{vmatrix} -2 & \cos C & \cos B \\ \cos C & -1 & \cos A \\ \cos B & \cos A & -1 \end{vmatrix} \text{ is equal to :}$$

A. 0

B. -1

C. 1

D. -2

Answer: B



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23. If the system of linear equations

$$x + 2ay + az = 0$$

$$x + 3by + bz = 0$$

$$x + 4cy + cz = 0$$

has a non-zero solution, then a, b, c

A. A.P

B. G.P

C. H.P

D. None of these

Answer: C



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24. if a, b and c are the roots of the equation $x^3 + 2x^2 + 1 = 0$, find

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

A. 8

B. -8

C. 0

D. 2

Answer: A



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25. The system of equations

$$\lambda x + (\lambda + 1)y + (\lambda - 1)z = 0, (\lambda + 1)x + \lambda y + (\lambda + z)z = 0, (\lambda - 1)x +$$

bas a non-trivial solutions for

A. exactly three real value of λ

B. exactly two real values of λ

C. exactly three real value of λ

D. infinitely many real value of λ

Answer: C



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26. If one root of the equation $\begin{vmatrix} 7 & 6 & x^2 - 13 \\ 2 & x^2 - 13 & 2 \\ x^2 - 13 & 3 & 7 \end{vmatrix} = 0$ is $x=2$ the

sum of all other five roots is

A. -2

B. 0

C. $2\sqrt{5}$

D. $\sqrt{15}$

Answer: A



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Exercise 2 One Or More Than One Answer Is Are Correct

1. Let $f(a, b) = \begin{vmatrix} a & a^2 & 0 \\ 1 & (2a + b) & (a + b)^2 \\ 0 & 1 & (2a + 3b) \end{vmatrix}$, then

A. $(2a+b)$ is a factor of $f(a,b)$

B. $(a+2b)$ is a factor of $f(a,b)$

C. $(a+b)$ is a factor of $f(a,b)$

D. a is factor of $f(a,b)$

Answer: B::C::D

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2. If $\begin{vmatrix} 1 + \cos^2 \theta & \sin^2 \theta & 2\sqrt{3} \tan \theta \\ \cos^2 \theta & 1 + \sin^2 \theta & 2\sqrt{3} \tan \theta \\ \cos^2 \theta & \sin^2 \theta & 1 + 2\sqrt{3} \tan \theta \end{vmatrix} = 0$ then θ may be :

A. $\frac{\pi}{6}$

B. $\frac{5\pi}{6}$

C. $\frac{7\pi}{6}$

D. $\frac{11\pi}{6}$

Answer: B::D



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3. Let $\Delta = \begin{vmatrix} a & a + b & a + 3d \\ a + d & a + 2d & a \\ a + 2d & a & a + d \end{vmatrix}$ then :

A. Δ depends on a

B. Δ depends on d

C. Δ is independent of a,d

D. $\Delta = 0$

Answer: A::B



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4. The value(s) of λ for which the system of equations

$$(1 - \lambda)x + 3y - 4z = 0$$

$$x - (3 + \lambda)y + 5z = 0$$

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

possesses non-trivial solutions .

A. -1

B. 0

C. 1

D. 2

Answer: A::B



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5. Let $D(x) = \begin{vmatrix} x^2 + 4x - 3 & 2x + 4 & 13 \\ 2x^2 + 5x - 9 & 4x + 5 & 26 \\ 8x^2 - 16x + 1 & 16x - 6 & 104 \end{vmatrix} = \alpha x^3 + \beta x^2 + \gamma x + \delta$

then :

A. $\alpha + \beta = 0$

B. $\beta + \gamma = 0$

C. $\alpha + \beta + \gamma + \delta = 0$

D. $\alpha + \beta + \gamma = 0$

Answer: A::B::D



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6. if the system of equations

$$ax + y + 2z = 0$$

$$x + 2y + z = b$$

$$2x + y + az = 0$$

has no solution then $(a+b)$ can be equals to :

A. -1

B. 2

C. 3

D. 4

Answer: B::C::D



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Exercise 3 Comprehension Type Problems

1. Consider the system of equations

$$2x + \lambda y + 6z = 8$$

$$x + 2y + \mu z = 5$$

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

The system of equations has :

No solution if :

A. $\lambda = 2, \mu = 3$

B. $\lambda \neq 2, \mu = 3$

C. $\lambda \neq 2, \mu \neq 3$

D. $\lambda = 2, \mu \in R$

Answer: B



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2. Consider the system of equations

$$2x + \lambda y + 6z = 8$$

$$x + 2y + \mu z = 5$$

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

The system of equations has : Exactly one solution if :

A. $\lambda = 2, \mu = 3$

B. $\lambda \neq 2, \mu = 3$

C. $\lambda \neq 2, \mu \neq 3$

D. $\lambda = 2, \mu \in R$

Answer: A



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3. Consider the system of equations

$$2x + \lambda y + 6z = 8$$

$$x + 2y + \mu z = 5$$

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

The system of equations has :

Infinitely many solutions if :

A. $\lambda = 2, \mu = 3$

B. $\lambda \neq 2, \mu = 3$

C. $\lambda \neq 2, \mu \neq 3$

D. $\lambda = 2, \mu \in R$

Answer: D



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Exercise 4 Subjective Type Problems

1. If 3^n is a factor of the determinant $\begin{vmatrix} 1 & 1 & 1 \\ .^n C_1 & .^{n+3} C_1 & .^{n+6} C_1 \\ .^n C_2 & .^{n+3} C_2 & .^{n+6} C_2 \end{vmatrix}$ then the maximum value of n is

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2. Find the value of λ for which

$$\begin{vmatrix} 2a_1 + b_1 & 2a_2 + b_2 & 2a_3 + b_3 \\ 2b_1 + c_1 & 2b_2 + c_2 & 2b_3 + c_3 \\ 2c_1 + a_1 & 2c_2 + a_2 & 2c_3 + a_3 \end{vmatrix} = \lambda \begin{vmatrix} a_1 & a_2 & a_3 \\ b_1 & b_2 & b_3 \\ c_1 & c_2 & c_3 \end{vmatrix}$$

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3. Let

$$\begin{vmatrix} y^5 z^6 (z^3 - y^3) & x^4 z^6 (x^3 - z^3) & x^4 y^5 (y^3 - x^3) \\ y^2 z^3 (y^6 - z^6) & x z^3 (z^6 - x^6) & x y^2 (x^6 - y^6) \\ y^2 (z^3 - y^3) & x z^3 (x^3 - z^3) & x y^2 (y^3 - x^3) \end{vmatrix} \text{ and } \Delta_2 = \begin{vmatrix} x \\ x^4 \\ x^7 \end{vmatrix}$$

.Then $\Delta_1 \Delta_2$ is equal to

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4. if the system of equations :

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

$$3x + 2y + kz = 0$$

$$4x + y + z = 0$$

have a set of non-zero integral solutions then , find the smallest positive value of z .



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5. Find $a \in R$ for which the system of equations $2ax-2y+3z=0$, $x+ay + 2z=0$ and $2x+az=0$ also have a non-trivial solution.



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6. If three non-zero distinct real numbers form an arithmetic progression and the squares of these numbers taken in the same order constitute a geometric progression. Find the sum of all possible common ratios of the geometric progression.



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7. Let $\Delta_1 = \begin{vmatrix} a_1 & a_2 & a_3 \\ b_1 & b_2 & b_3 \\ c_1 & c_2 & c_3 \end{vmatrix}$, $\Delta_2 = \begin{vmatrix} 6a_1 & 2a_2 & 2a_3 \\ 3b_1 & b_2 & b_3 \\ 12c_1 & 4c_2 & 4c_3 \end{vmatrix}$ and

$$\Delta_3 = \begin{vmatrix} 3a_1 + b_1 & 3a_2 + b_2 & 3a_3 + b_3 \\ 3b_1 & 3b_2 & 3b_3 \\ 3c_1 & 3c_2 & 3c_3 \end{vmatrix}$$

then $\Delta_3 - \Delta_2 = k\Delta_1$, find k.

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8. The minimum value of determinant

$$\Delta = \begin{vmatrix} 1 & \cos \theta & 1 \\ -\cos \theta & 1 & \cos \theta \\ -1 & -\cos \theta & 2 \end{vmatrix} \quad \forall \theta \in R \text{ is :}$$

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9. For a unique value of μ & λ , the system of equations given by

$$x + y + z = 6$$

$$x + 2y + 3z = 14$$

$$2x + 5y + \lambda z = \mu$$

has infinitely many solutions, then $\frac{\mu - \lambda}{4}$ is equal to



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10. Let $\lim_{n \rightarrow \infty} n \sin (2\pi e \lfloor n \rfloor) = k\pi$, where $n \in \mathbb{N}$. Find k :



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11. If the system of linear equations

$$(\cos \theta)x + (\sin \theta)y + \cos \theta = 0$$

$$(\sin \theta)x + (\cos \theta)y + \sin \theta = 0$$

$$(\cos \theta)x + (\sin \theta)y - \cos \theta = 0$$

is consistent, then the number of possible values of θ , $\theta \in [0, 2\pi]$ is :



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