MATHS

BOOKS - VIKAS GUPTA 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 $\begin{vmatrix} a & a^2 & 1+a^3 \\ b & b^2 & 1+b^3 \\ c & c^2 & 1+c^2 \end{vmatrix} = 0$ and vectors $(1, a, a^2)$, $(1, b, b^2)$ and $(1, c, c^2)$ are hon coplanar then the product abc equals

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,..... , 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 $a_1, a_2, a_3, \ldots.., a_n$ 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 $\Delta_1 = \begin{vmatrix} 1 & 1 & 1 \\ a & b & c \\ a^2 & b^2 & c^2 \end{vmatrix}, \Delta_2 = \begin{vmatrix} 1 & bc & a \\ 1 & ca & b \\ 1 & ab & c \end{vmatrix}$, 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 $\begin{vmatrix} -2 & \cos C & \cos B \\ \cos C & -1 & \cos A \\ \cos B & \cos A & -1 \end{vmatrix}$ is equal to :

A. 0

B. -1

C. 1

D. -2

Answer: D

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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

24. If a,b and c are the roots of the equation $x^3 + 2x^2 + 1 = 0$, find $\begin{vmatrix} a & b & c \\ b & c & a \\ c & a & b \end{vmatrix}$.

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. $= \left|aa^2 012a+b(a+b)012a+3b\right|$ is divisible by $a+b$ b. $a+2b$ c. $2a+3b$ d. a^2

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: A::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: A

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Exercise 4 Subjective Type Problems

1. The greatest value of n for which the determinant

$$\Delta = \begin{vmatrix} 1 & 1 & 1 \\ .^{n}C_1 & .^{n+3}C_1 & .^{n+6}C_1 \\ .^{n}C_2 & .^{n+3}C_2 & .^{n+6}C_2 \end{vmatrix}$$ is divisible by 3^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. Simplify $\begin{vmatrix} (1+x)^2 & (1+x)^4 & (1+x)^6 \\ (1+x)^3 & (1+x)^6 & (1+x)^9 \\ (1+x)^4 & (1+x)^8 & (1+x)^{12} \end{vmatrix}$

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4. Let

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

.Then $\Delta_1\Delta_2$ is equal to

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5. 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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6. 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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7. If three non-zero distinct real numbers form an arithmatic 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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8. 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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9. The minimum value of determinant $\Delta = \begin{vmatrix} 1 & \cos\theta & 1 \\ -\cos\theta & 1 & \cos\theta \\ -1 & -\cos\theta & 2 \end{vmatrix} \forall \theta \in R$ is :

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10. 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 $\dfrac{\mu - \lambda}{4}$ is equal to

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11. Let $\lim_{n \to \infty}$ n sin (2π e $\lfloor n$)= k π, where $n\pi N$. Find k :

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12. 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 $\theta, \theta \in [0, 2\pi]$ is :

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