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Daily Practice Problems

MATHS

Topic - Determinants & Matrix

Q.1 If $a^2 + b^2 + c^2 = 1$ then $ab + bc + ca$ lies in the interval :

(A) $\left[\frac{1}{2}, 2\right]$ (B) $[-1, 2]$ (C) $\left[-\frac{1}{2}, 1\right]$ (D) $\left[-1, \frac{1}{2}\right]$

Q.2 The value of the determinant $\begin{vmatrix} a^2 & a & 1 \\ \cos(nx) & \cos(n+1)x & \cos(n+2)x \\ \sin(nx) & \sin(n+1)x & \sin(n+2)x \end{vmatrix}$ is independent of :

(A) n (B) a (C) x (D) a , n and x

Q.3 A is an involutary matrix given by $A = \begin{bmatrix} 0 & 1 & -1 \\ 4 & -3 & 4 \\ 3 & -3 & 4 \end{bmatrix}$ then the inverse of $\frac{A}{2}$ will be

(A) 2A (B) $\frac{A^{-1}}{2}$ (C) $\frac{A}{2}$ (D) A^2

Q.4 If $P(x) = ax^2 + bx + c$ & $Q(x) = -ax^2 + dx + c$, where $ac \neq 0$, then $P(x) . Q(x) = 0$ has

(A) exactly one real root (B) atleast two real roots
(C) exactly three real roots (D) all four are real roots .

Q.5 If a, b, c are all different from zero & $\begin{vmatrix} 1+a & 1 & 1 \\ 1 & 1+b & 1 \\ 1 & 1 & 1+c \end{vmatrix} = 0$, then the value of $a^{-1} + b^{-1} + c^{-1}$ is

(A) abc (B) $a^{-1} b^{-1} c^{-1}$ (C) $-a - b - c$ (D) -1

Q.6 If A and B are symmetric matrices, then ABA is

(A) symmetric matrix (B) skew symmetric
(C) diagonal matrix (D) scalar matrix

Q.7 Let $a > 0, b > 0$ & $c > 0$. Then both the roots of the equation $ax^2 + bx + c = 0$

(A) are real & negative (B) have negative real parts
(C) are rational numbers (D) none

Q.8 If $\alpha, \beta \& \gamma$ are real numbers, then $D = \begin{vmatrix} 1 & \cos(\beta-\alpha) & \cos(\gamma-\alpha) \\ \cos(\alpha-\beta) & 1 & \cos(\gamma-\beta) \\ \cos(\alpha-\gamma) & \cos(\beta-\gamma) & 1 \end{vmatrix} =$

(A) -1 (B) $\cos\alpha\ \cos\beta\ \cos\gamma$
(C) $\cos\alpha + \cos\beta + \cos\gamma$ (D) zero

Q.9 The real values of 'a' for which the quadratic equation, $2x^2 - (a^3 + 8a - 1)\,x + a^2 - 4a = 0$ possesses roots of opposite signs is given by :
(A) $a > 5$ (B) $0 < a < 4$ (C) $a > 0$ (D) $a > 7$

Q.10 If $A = \begin{bmatrix} \cos\theta & -\sin\theta \\ \sin\theta & \cos\theta \end{bmatrix}$, A^{-1} is given by
(A) $-A$ (B) A^T (C) $-A^T$ (D) A

Q.11 The minimum value of the expression $|x-p| + |x-15| + |x-p-15|$ for 'x' in the range $p \le x \le 15$ where $0 < p < 15$, is
(A) 10 (B) 15 (C) 30 (D) 0

Q.12 If the system of equations $ax+y+z=0$, $x+by+z=0$ & $x+y+cz=0$ $(a, b, c \ne 1)$ has a non-trivial solution, then the value of $\frac{1}{1-a} + \frac{1}{1-b} + \frac{1}{1-c}$ is :
(A) -1 (B) 0 (C) 1 (D) none of these

Q.13 If a, b, c are real numbers satisfying the condition $a+b+c=0$ then the roots of the quadratic equation $3ax^2 + 5bx + 7c = 0$ are :
(A) positive (B) negative (C) real & distinct (D) imaginary

Q.14 Consider the matrices $A = \begin{bmatrix} 4 & 6 & -1 \\ 3 & 0 & 2 \\ 1 & -2 & 5 \end{bmatrix}$, $B = \begin{bmatrix} 2 & 4 \\ 0 & 1 \\ -1 & 2 \end{bmatrix}$, $C = \begin{bmatrix} 3 \\ 1 \\ 2 \end{bmatrix}$. Out of the given matrix products
(i) $(AB)^TC$ (ii) $C^TC(AB)^T$ (iii) C^TAB and (iv) A^TABB^TC
(A) exactly one is defined (B) exactly two are defined
(C) exactly three are defined (D) all four are defined

Q.15 If the difference of the roots of the equation, $x^2 + ax + b = 0$ is equal to the difference of the roots of the equation $x^2 + bx + a = 0$ then :
(A) $a + b = 4$ (B) $a + b = -4$ (C) $a - b = 4$ (D) $a - b = -4$

Q.16 The value of a for which the system of equations ; $a^3x + (a+1)^3 y + (a+2)^3 z = 0$, $ax + (a+1)\,y + (a+2)\,z = 0$ & $x + y + z = 0$ has a non-zero solution is :
(A) 1 (B) 0 (C) -1 (D) none of these

Q.17 Suppose a, b, and c are positive numbers such that $a + b + c = 1$. Then the maximum value of $ab + bc + ca$ is
(A) $\frac{1}{3}$ (B) $\frac{1}{4}$ (C) $\frac{1}{2}$ (D) $\frac{2}{3}$

Q.18 If $A = \begin{pmatrix} 1 & a \\ 0 & 1 \end{pmatrix}$, then A^n (where $n \in N$) equals

(A) $\begin{pmatrix} 1 & na \\ 0 & 1 \end{pmatrix}$ (B) $\begin{pmatrix} 1 & n^2 a \\ 0 & 1 \end{pmatrix}$ (C) $\begin{pmatrix} 1 & na \\ 0 & 0 \end{pmatrix}$ (D) $\begin{pmatrix} n & na \\ 0 & n \end{pmatrix}$

Q.19 The roots of $(x-1)(x-3) + K(x-2)(x-4) = 0,\ K > 0$ are :
(A) real (B) real & equal (C) imaginary (D) one real & one imaginary

Q.20 Let $f(x) = \begin{vmatrix} 1+\sin^2 x & \cos^2 x & 4\sin 2x \\ \sin^2 x & 1+\cos^2 x & 4\sin 2x \\ \sin^2 x & \cos^2 x & 1+4\sin 2x \end{vmatrix}$, then the maximum value of $f(x) =$

(A) 2 (B) 4 (C) 6 (D) 8

Q.21 Largest integral value of m for which the quadratic expression
$y = x^2 + (2m+6)x + 4m + 12$ is always positive, $\forall\ x \in R$, is
(A) – 1 (B) – 2 (C) 0 (D) 2

Q.22 If $A = \begin{bmatrix} 3 & 4 \\ 1 & -6 \end{bmatrix}$ and $B = \begin{bmatrix} -2 & 5 \\ 6 & 1 \end{bmatrix}$ then X such that $A + 2X = B$ equals

(A) $\begin{bmatrix} 2 & 3 \\ -1 & 0 \end{bmatrix}$ (B) $\begin{bmatrix} 3 & 5 \\ -1 & 0 \end{bmatrix}$ (C) $\begin{bmatrix} 5 & 2 \\ -1 & 0 \end{bmatrix}$ (D) none of these

Q.23 If $px^4 + qx^3 + rx^2 + sx + t \equiv \begin{vmatrix} x^2+3x & x-1 & x+3 \\ x+1 & 2-x & x-3 \\ x-3 & x+4 & 3x \end{vmatrix}$ then $t =$

(A) 33 (B) 0 (C) 21 (D) none

Q.24 Let $P(x) = kx^3 + 2k^2x^2 + k^3$. Find the sum of all real numbers k for which $x - 2$ is a factor of P(x).
(A) 4 (B) 8 (C) – 4 (D) – 8

Q.25 If A and B are invertible matrices, which one of the following statements is not correct
(A) Adj. $A = |A|\, A^{-1}$ (B) $\det(A^{-1}) = |\det(A)|^{-1}$
(C) $(A + B)^{-1} = B^{-1} + A^{-1}$ (D) $(AB)^{-1} = B^{-1}A^{-1}$

Q.26 The sum of all the value of m for which the roots x_1 and x_2 of the quadratic equation $x^2 - 2mx + m = 0$ satisfy the condition $x_1^3 + x_2^3 = x_1^2 + x_2^2$, is

(A) $\frac{3}{4}$ (B) 1 (C) $\frac{9}{4}$ (D) $\frac{5}{4}$

Q.27 If $D = \begin{vmatrix} a^2+1 & ab & ac \\ ba & b^2+1 & bc \\ ca & cb & c^2+1 \end{vmatrix}$ then $D =$

(A) $1 + a^2 + b^2 + c^2$ (B) $a^2 + b^2 + c^2$ (C) $(a+b+c)^2$ (D) none

Q.28 If $A = \begin{bmatrix} a & b \\ c & d \end{bmatrix}$ satisfies the equation $x^2 - (a + d)x + k = 0$, then

(A) $k = bc$ (B) $k = ad$ (C) $k = a^2 + b^2 + c^2 + d^2$ (D) $ad - bc$

Q.29 Let r_1, r_2 and r_3 be the solutions of the equation $x^3 - 2x^2 + 4x + 5074 = 0$ then the value of $(r_1 + 2)(r_2 + 2)(r_3 + 2)$ is

(A) 5050 (B) 5066 (C) – 5050 (D) – 5066

Q.30 If $a, b, c > 0$ & $x, y, z \in R$, then the determinant $\begin{vmatrix} (a^x + a^{-x})^2 & (a^x - a^{-x})^2 & 1 \\ (b^y + b^{-y})^2 & (b^y - b^{-y})^2 & 1 \\ (c^z + c^{-z})^2 & (c^z - c^{-z})^2 & 1 \end{vmatrix} =$

(A) $a^x b^y c^z$ (B) $a^{-x} b^{-y} c^{-z}$ (C) $a^{2x} b^{2y} c^{2z}$ (D) zero

Q.31 The sum of the roots of the equation $(x + 1) = 2 \log_2(2^x + 3) - 2 \log_4(1980 - 2^{-x})$ is

(A) 3954 (B) $\log_2 11$ (C) $\log_2 3954$ (D) indeterminate

Q.32 Identify the incorrect statement in respect of two square matrices A and B conformable for sum and product.

(A) $t_r(A + B) = t_r(A) + t_r(B)$ (B) $t_r(\alpha A) = \alpha\, t_r(A), \alpha \in R$

(C) $t_r(A^T) = t_r(A)$ (D) $t_r(AB) \neq t_r(BA)$

Q.33 If $a + b + c = 0$ & $a^2 + b^2 + c^2 = 1$ then the value of $a^4 + b^4 + c^4$ is

(A) 3/ 2 (B) 3/4 (C) 1/2 (D) 1/4

Q.34 The determinant $\begin{vmatrix} \cos(\theta+\phi) & -\sin(\theta+\phi) & \cos 2\phi \\ \sin\theta & \cos\theta & \sin\phi \\ -\cos\theta & \sin\theta & \cos\phi \end{vmatrix}$ is :

(A) 0 (B) independent of θ

(C) independent of ϕ (D) independent of θ & ϕ both

Q.35 The equation whose roots are $\sec^2\alpha$ & $\operatorname{cosec}^2\alpha$ can be :

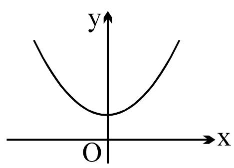
(A) $2x^2 - x - 1 = 0$ (B) $x^2 - 3x + 3 = 0$ (C) $x^2 - 9x + 9 = 0$ (D) none

Q.36 If A and B are non singular Matrices of same order then Adj. (AB) is

(A) Adj. (A) (Adj. B) (B) (Adj. B) (Adj. A)

(C) Adj. A + Adj. B (D) none of these

Q.37 The graph of a quadratic polynomial $y = ax^2 + bx + c$ $(a, b, c \in R)$ with vertex on y-axis is as shown in the figure. Then which one of the following statement is INCORRECT?



(A) Product of the roots of the corresponding quadratic equation is positive.

(B) Discriminant of the quadratic equation is negative.

(C) Nothing definite can be said about the sum of the roots, whether positive, negative or zero.

(D) Both roots of the quadratic equation are purely imaginary.

Q.38 If $\begin{vmatrix} a+1 & a+2 & a+p \\ a+2 & a+3 & a+q \\ a+3 & a+4 & a+r \end{vmatrix} = 0$, then p, q, r are in :

(A) AP (B) GP (C) HP (D) none

Q.39 The number of solution of the equation $e^{2x} + e^{x} + e^{-2x} + e^{-x} = 3(e^{-2x} + e^{x})$ is

(A) 0 (B) 2 (C) 1 (D) more than 2

Q.40 Let $A = \begin{bmatrix} x+\lambda & x & x \\ x & x+\lambda & x \\ x & x & x+\lambda \end{bmatrix}$, then A^{-1} exists if

(A) $x \neq 0$ (B) $\lambda \neq 0$

(C) $3x + \lambda \neq 0, \lambda \neq 0$ (D) $x \neq 0, \lambda \neq 0$

Q.41 Let a, b, c be the three roots of the equation $x^3 + x^2 - 333x - 1002 = 0$ then the value of $a^3 + b^3 + c^3$.

(A) 2006 (B) 2005 (C) 2003 (D) 2002

Q.42 For positive numbers x, y & z the numerical value of the determinant $\begin{vmatrix} 1 & \log_x y & \log_x z \\ \log_y x & 1 & \log_y z \\ \log_z x & \log_z y & 1 \end{vmatrix}$ is

(A) 0 (B) 1 (C) 3 (D) none

Q.43 If $K \in R_0$ then det. {adj (KI_n)} is equal to

(A) K^{n-1} (B) $K^{n(n-1)}$ (C) K^n (D) K

Q.44 The number of real roots of the equation $\sqrt{x^2+1} - \sqrt{2x^2+5} = 1$ is

(A) 4 (B) 2 (C) 1 (D) 0

Q.45 The determinant $\begin{vmatrix} b_1+c_1 & c_1+a_1 & a_1+b_1 \\ b_2+c_2 & c_2+a_2 & a_2+b_2 \\ b_3+c_3 & c_3+a_3 & a_3+b_3 \end{vmatrix} =$

(A) $\begin{vmatrix} a_1 & b_1 & c_1 \\ a_2 & b_2 & c_2 \\ a_3 & b_3 & c_3 \end{vmatrix}$ (B) $2\begin{vmatrix} a_1 & b_1 & c_1 \\ a_2 & b_2 & c_2 \\ a_3 & b_3 & c_3 \end{vmatrix}$ (C) $3\begin{vmatrix} a_1 & b_1 & c_1 \\ a_2 & b_2 & c_2 \\ a_3 & b_3 & c_3 \end{vmatrix}$ (D) $4\begin{vmatrix} a_1 & b_1 & c_1 \\ a_2 & b_2 & c_2 \\ a_3 & b_3 & c_3 \end{vmatrix}$

Q.46 Which of the following is an orthogonal matrix

(A) $\begin{bmatrix} 6/7 & 2/7 & -3/7 \\ 2/7 & 3/7 & 6/7 \\ 3/7 & -6/7 & 2/7 \end{bmatrix}$ (B) $\begin{bmatrix} 6/7 & 2/7 & 3/7 \\ 2/7 & -3/7 & 6/7 \\ 3/7 & 6/7 & -2/7 \end{bmatrix}$

(C) $\begin{bmatrix} -6/7 & -2/7 & -3/7 \\ 2/7 & 3/7 & 6/7 \\ -3/7 & 6/7 & 2/7 \end{bmatrix}$ (D) $\begin{bmatrix} 6/7 & -2/7 & 3/7 \\ 2/7 & 2/7 & -3/7 \\ -6/7 & 2/7 & 3/7 \end{bmatrix}$

Q.47 Number of integral values of x satisfying the inequality $\left(\frac{3}{4}\right)^{6x+10-x^2} < \frac{27}{64}$ is

(A) 6 (B) 7 (C) 8 (D) infinite

Q.48 The determinant $\begin{vmatrix} 1+a+x & a+y & a+z \\ b+x & 1+b+y & b+z \\ c+x & c+y & 1+c+z \end{vmatrix} =$

(A) $(1+a+b+c)(1+x+y+z) - 3(ax+by+cz)$
(B) $a(x+y) + b(y+z) + c(z+x) - (xy+yz+zx)$
(C) $x(a+b) + y(b+c) + z(c+a) - (ab+bc+ca)$
(D) none of these

Q.49 Which of the following statements is incorrect for a square matrix A. ($|A| \neq 0$)
(A) If A is a diagonal matrix, A^{-1} will also be a diagonal matrix
(B) If A is a symmetric matrix, A^{-1} will also be a symmetric matrix
(C) If $A^{-1} = A \Rightarrow$ A is an idempotent matrix
(D) If $A^{-1} = A \Rightarrow$ A is an involutary matrix

Q.50 The set of real value(s) of p for which the equation, $|2x+3| + |2x-3| = px + 6$ has more than two solutions is :
(A) $(0, 4]$ (B) $(-4, 4)$ (C) $R - \{4, -4, 0\}$ (D) $\{0\}$

Answer Key

Que.	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Ans.	C	A	A	B	D	A	B	D	B	B
Que.	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
Ans.	B	C	C	C	B	C	A	A	A	C
Que.	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**
Ans.	C	D	C	D	C	D	A	D	C	D
Que.	**31**	**32**	**33**	**34**	**35**	**36**	**37**	**38**	**39**	**40**
Ans.	B	D	C	B	C	B	C	A	C	C
Que.	**41**	**42**	**43**	**44**	**45**	**46**	**47**	**48**	**49**	**50**
Ans.	A	A	B	D	B	A	B	A	C	D