

MATHS

BOOKS - KC SINHA ENGLISH

ALGEBRA - PREVIOUS YEAR QUESTIONS - FOR COMPETITION

Exercise

1. Let $p \, \, {
m and} \, \, q$ be real numbers such that $p
eq 0, \, p^3
eq q, \, \, {
m and} \, \, p^3
eq \, -q \cdot$ α and β are nonzero complex numbers satisfying If $lpha+eta=-p \,\, {
m and} \,\, lpha^3+eta^3=q$, then a quadratic equation having α / β and β / α as its roots is A. $(p^3+q)x^2-(p^3+2q)x+(p^3+q)=0$ Β. $(p^3+q)x^2-(p^3-2q)x+(p^3+q)=0$ C. $(p^3+q)x^2-(5p^3-2q)x+(p^3-q)=0$ D. $(p^3+q)x^2 - (5p^3+2q)x + (p^3+q) = 0$

2. The number of 3 imes 3 matrices A whose entries are either $0 \ {
m or} \ 1$ and

for which the system $A \begin{vmatrix} x \\ y \\ z \end{vmatrix} = \begin{vmatrix} 1 \\ 0 \\ 0 \end{vmatrix}$ has exactly two distinct solution is a. 0

b. 2^9-1 c. 168 d. 2

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4. Let
$$S_k, k = 1, 2, ..., 100$$
 denote the sum of the infinite geometric series whose first term is $\frac{k-1}{K!}$ and the common ration is $\frac{1}{k}$ then the value of $\frac{(100)^2}{100!} + \sum_{k=1}^{100} |(k^2-3k+1)S_k|$ is _____`

5. Let $S=\{1,\,,2,\,34\}$. The total number of unordered pairs of disjoint subsets of S is equal a.25 b. 34 c. 42 d. 41

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6. For r = 0, 1, ..., 10, let A_r, B_r , and C_r denote, respectively, the coefficient of x^r in the expansion of $(1 + x)^{10}$, $(1 + x)^{20}$ and $(1 + x)^{30}$. Then $\sum_{r=1}^{10} A_r (B_{10}B_r - C_{10}A_r)$ is equal to Watch Video Solution

7. Let
$$(a_1, a_2, a_3, \dots, a_{11})$$
 be real numbers satsfying
 $a_1 = 15, 27 - 2a_2 > 0$ and $a_k = 2a_{k-1} - a_{k-2}$ for $k = 3, 4, \dots, 11$,
If
 $\frac{a_1^2 + a_2^2 + \dots + a_{11}^2}{11} = 90$ then the value of $\frac{a_1 + a_2 + \dots + a_1}{11}$
is equal to _____.

8. Let P be an odd prime number and T_p be the following set of 2 imes 2

matrices :

$$T_P=igg\{A=igg[egin{array}{c}a&b\c&a\end{array}:a,b,c\in\{0,1,...,p-1\}igg\}$$

The number of A in T_P such that det (A) is not divisible by p is

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9. Let P be an odd prime number and T_p be the following set of 2 imes 2

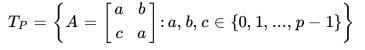
matrices :

$$T_P=igg\{A=igg[egin{array}{c} a & b \ c & a \ \end{bmatrix}\!:\!a,b,c\in\{0,1,...,p-1\}igg\}$$

The number of A in T_P such that det (A) is not divisible by p is

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10. Let P be an odd prime number and T_p be the following set of 2×2 matrices :



The number of A in T_P such that det (A) is not divisible by p is

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11. The number of 3 x 3 non-singular matrices, with four entries as 1 and

all other entries as 0, is:- (1) 5 (2) 6 (3) at least 7 (4) less than 4



12. Let a be a 2 imes 2 matrix with non-zero entries and let $A^2=I$, where I

is a 2 imes 2 identity matrix. Define Tr(A)= sum of diagonal elements of A and

|A| = determinant of matrix A.

Statement 1 : Tr (A) = 0

Statement 2 : |A| = 1



13. A person is to count 4500 currency notes. Let a_n denote the number of notes he counts is the n^{th} minute .lf $a_1 = a_2 = \dots = a_{10}$ = 150 and $a_{10}, a_{11}...$, are in A.P with common difference -2, then the time to count all notes

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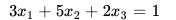
14. There are two urns. Urn A has 3 distinct red balls and urn B has 9 distinct blue balls. From each urn, two balls are taken out at random and then transferred to the other. The number of ways in which this can be done. Is

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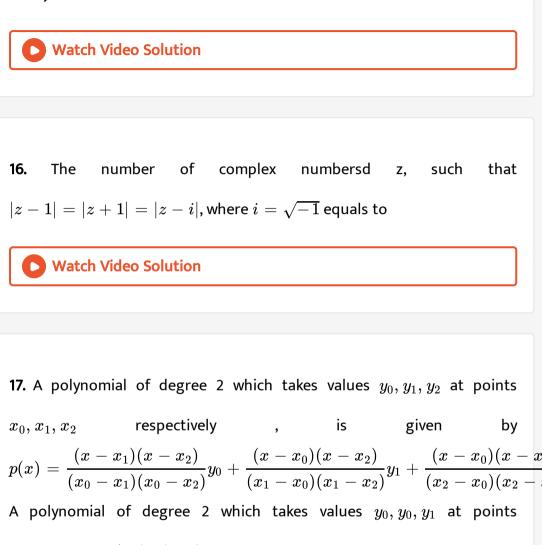
15. consider the system of linear equations

 $x_1 + 2x_2 + x_3 = 3$

 $2x_1 + 3x_2 + x_3 = 3,$



the system has



$$x_0, x_{0+t}, x_1 \, t
eq 0$$
 is given by

18. Let α and β be the roots of the equation $x^2 - 6x - 2 = 0$. If $a_n = \alpha^n - \beta^n$. For $n \ge 1$, then the value of $\dfrac{a_{10} - 2a_8}{2a_9}$ is :

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19. Let M and N be two 3×3 nonsingular skew-symmetric matrices such that Mn = NM. If P^T denotes the transpose of P, then $M^2N^2(M^TN)^{-1}(MN^{-1})^T$ is equal to

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20. Let $\omega \neq 1$ be cube root of unity and S be the set of all non-singular matrices of the form $[1ab\omega 1c\omega^2 \omega 1]$, where each of a, b, andc is either ω or ω^2 . Then the number of distinct matrices in the set S is a. 2 b. 6 c. 4 d. 8

21. Let a, b, and c be three real numbers satifying $\begin{bmatrix} a & b & c \end{bmatrix}$

 $\begin{bmatrix} 1 & 9 & 7 \\ 8 & 2 & 7 \\ 7 & 3 & 7 \end{bmatrix} = \begin{bmatrix} 0 & 0 & 0 \end{bmatrix}$ If the point P(a, b, c) with reference to (E) lies on the plane 2x + y + z = 1, then the value of 7a + b + c is

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22. Let a, b, and c be three real numbers satifying $\begin{bmatrix} a & b & c \end{bmatrix}$

$$\begin{bmatrix} 1 & 9 & 7 \\ 8 & 2 & 7 \\ 7 & 3 & 7 \end{bmatrix} = \begin{bmatrix} 0 & 0 & 0 \end{bmatrix}$$

Let ω be a solution of $x^3 - 1 = 0$ with $Im(\omega) > 0$. If $a = 2$ with b and c satisfying (E), then the value of $\frac{3}{\omega^a} + \frac{1}{\omega^b} + \frac{3}{\omega^c}$ is equal to

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23. Let a, b, and c be three real numbers satifying $\begin{bmatrix} a & b & c \end{bmatrix}$

$$egin{bmatrix} 1 & 9 & 7 \ 8 & 2 & 7 \ 7 & 3 & 7 \end{bmatrix} = \begin{bmatrix} 0 & 0 & 0 \end{bmatrix}$$

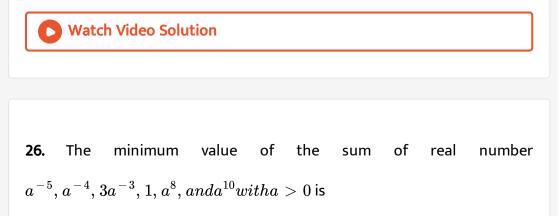
Let b=6, with a and c satisfying (E). If α and β are the roots of the quadratic equation $ax^2 + bx + c = 0$, then $\sum_{n=0}^{\infty} \left(\frac{1}{\alpha} + \frac{1}{\beta}\right)^n$ is

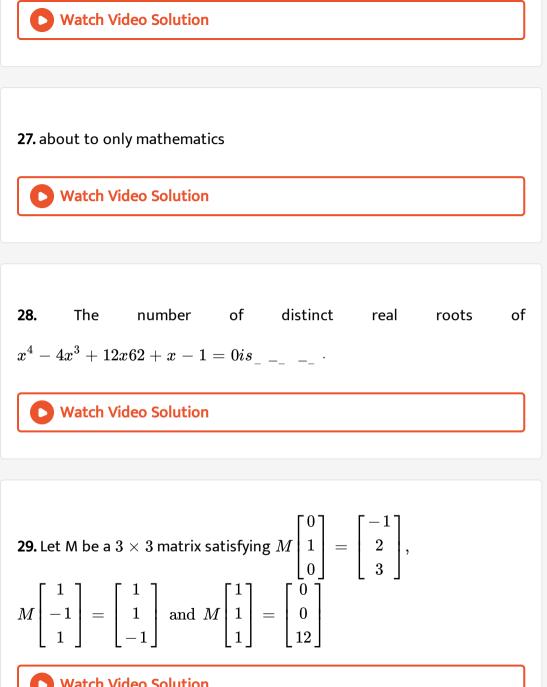
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24. Let a_1, a_2, a_3, a_{100} be an arithmetic progression with $a_1 = 3ands_p = \sum_{i=1}^p a_i, 1 \le p \le 100$. For any integer n with $1 \le n \le 20$, let m = 5n. If $\frac{S_m}{S_n}$ does not depend on n, then a_2 is_____.

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30. Find the coefficient of x^7 in the expansion of $\left(1-x-x^2+x^3
ight)^6$.



31. Let α, β be real and z be a complex number. If $z^2 + \alpha z + \beta = 0$ has two distinct roots on the line Re z = 1 , then it is necessary that : (1) $b \in (0, 1)$ (2) $b \in (-1, 0)$ (3) |b| = 1 (4) $b \in (1, \infty)$

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32. 38. Assertion (A): The area of a rectangle is 630 sq.cm and its breadth

is 15cm then its lengthis 55 cm

Reason (R): The area of a rectangle is given by A = length x breadtha)

- (A) Both A and R are true and R is correct explanation of A
- (B) Both A and R are true and R is not correct explanation of A
- (C) A is false and R is true.

33. A man saves Rs. 200 in each of the first three months of his service. In each of the subsequent months his saving increases by Rs. 40 more than the saving of immediately previous month. His total saving from the start of service will be Rs. 11040 after how many months

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34. If $\omega(\,
eq 1)$ is a cube root of unity, and $\left(1+\omega
ight)^7=A+B\omega$. Then (A,

B) equals

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35. The number of values of k for which the linear equations

4x + ky + 2z = 0

kx + 4y + z = 0

2x + 2y + z = 0

possess a non-zero solution is

36. Statement-1 : The number of ways of distributing 10 identical balls in 4 distinct boxes such that no box is empty is $^{9}C_{3}$. Statement-2 : The number of ways of choosing any 3 places from 9 different places is $^{9}C_{3}$. Statement-1 is true, Statement-2 is true; Statement-2 is a correct explanation for Statement-1. Statement-1 is true, Statement-2 is true;

Statement-2 is not a correct explanation for Statement-1. Statement-1 is

true, Statement-2 is false. Statement-1 is false, Statement-2 is true.

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37. If P is a 3 imes 3 matrix such that $P^T = 2P + I$, where P^T is

the transpose of P and I is the 3×3 identity matrix, then

there exists a column matrix
$$X = \begin{bmatrix} x \\ y \\ z \end{bmatrix}
eq \begin{bmatrix} 0 \\ 0 \\ 0 \end{bmatrix}$$
 such that

38. Let $a_1, a_2, a_3, ...$ be in harmonic progression with $a_1=5anda_{20}=25$. The least positive integer n for which $a_n<0.22$ b. 23 c. 24 d. 25



39. If the adjoint of a
$$3 \times 3$$
 matrix P is $\begin{bmatrix} 1 & 4 & 4 \\ 2 & 1 & 7 \\ 1 & 1 & 3 \end{bmatrix}$, then the

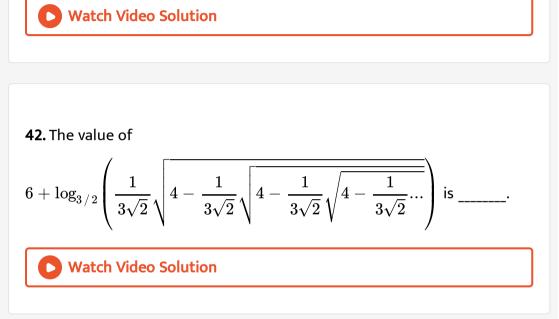
possible value (s) of the determinant of P is (are)

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40. Let z be a complex number such that the imaginary part of z is nonzero and $a = z^2 + z + z + 1$ is real. Then a cannot take the value.

41. The total number of ways in which 5 balls of different colours can be

distributed among 3 persons, so that each person gets atleast one ball is



43. Let a_n denotes the number of all n-digits positive integer formed by the digits 0,1 or both such that no consecutive diigits in them are 0. let b_n be the number of such n-digit integers ending with digit 1 and c_n be the number of such n digits integers ending with digit 0.

Q. The value of b_6 , is

44. Let a_n denotes the number of all n-digits positive integer formed by the digits 0,1 or both such that no consecutive diigits in them are 0. let b_n be the number of such n-digit integers ending with digit 1 and c_n be the number of such n digits integers ending with digit 0.

Q. The value of b_6 , is

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45. The equation $e^{\sin x} - e^{-\sin x} - 4 = 0$ has

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46. Statement 1:

The sum of the series 1+(1+2+4)+(4+6+9)+(9+12+16)+....+(361 +380 +400) is

8000

Statement 1:

$$\sum\limits_{k=1}^n \Bigl(k^3-(k-1)^3\Bigr)=n^3$$
, for any natural number n.

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47. Let
$$A = \begin{pmatrix} 1 & 0 & 0 \\ 2 & 1 & 0 \\ 3 & 2 & 1 \end{pmatrix}$$
. If u_1 and u_2 are column matrices such that $Au_1 = \begin{pmatrix} 1 \\ 0 \\ 0 \end{pmatrix}$ and $Au_2 = \begin{pmatrix} 0 \\ 1 \\ 0 \end{pmatrix}$, then $u_1 + u_2$ is equal to :

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48. If n is a positive integer, then $(\sqrt{3}+1)^{2n} - (\sqrt{3}-1)^{2n}$ is (1) an irrational number (2) an odd positive integer (3) an even positive integer (4) a rational number other than positive integers

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49. If 100 times the 100^{th} term of an AP with non zero common difference equals the 50 times its 50^{th} term, then the 150^{th} term of this AP is (1) 150 (2) 150 times its 50^{th} term (3) 150 (4) zero

50. Out of 10 white, 9 black, and 7 red balls, find the number of ways in which selection of one or more balls can be made (balls of the same color are identical).

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51. If $z \neq 1$ and $\frac{z^2}{z-1}$ is real, then the point represented by the complex number z lies (1) either on the real axis or on a circle passing through the origin (2) on a circle with centre at the origin (3) either on the real axis or on a circle not passing through the origin (4) on the imaginary axis

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52. Let P and Q be 3 imes 3 matrices P
eq Q. If $P^3=Q^3$ and $P^2Q=Q^2P$, then determinant of $\left(P^2+Q^2
ight)$ is equal to :

