MATHS

BOOKS - SURA MATHS (TAMIL ENGLISH)

THEORY OF EQUATIONS

Exercise 3 1

1. If the sides of a cunbic box are increased by 1, 2, 3 units respectively to form a cuboid, then the volume is increased by 52 cubic units. Find the volume of the cuboid.

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2. Equation with roots 1, 2 and 3

3. Equation with roots 1, 1 and -2

4. Equation with roots $2, \frac{1}{2}$ and 1

5. If α, β and γ are the roots of the cubic equation $x^3 + 2x^2 + 3x + 4 = 0$, for a cubic equation roots are $2\alpha, 2\beta, 2\gamma$

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6. If α, β and γ are the roots of the cubic equation $x^3 + 2x^2 + 3x + 4 = 0$, for a cubic equation roots are $\frac{1}{\alpha}, \frac{1}{\beta}, \frac{1}{\gamma}$

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7. If α, β and γ are the roots of the cubic equation $x^3 + 2x^2 + 3x + 4 = 0$, for a cubic equation roots are

$-\alpha, \ -\beta, \ -\gamma$

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8. Solve the equation $3x^3 - 16x^2 + 23x - 6 = 0$ if the product of two roots is 1.

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9. Find the sum of squares of roots of the equation $2x^4 - 8x^3 + 6x^2 - 3 = 0$

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10. Solve the equation $x^3 - 9x^2 + 14x + 24 = 0$ if it is given that two of its roots are in the rotio 3:2.

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11. If α, β and γ are the roots of the polynomlal equation $ax^3 + bx^2 + cx + d = 0$, find the value of $\Sigma \frac{a}{\beta\gamma}$ in terms of the coefficients.

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12. If α, β, γ and δ are the roots of the polynomial eqauation $2x^4 + 5x^3 - 7x^2 - 8 = 0$, find a quadratic

equation with integer corddicients whose roots are $\alpha+\beta+\gamma+\delta$ and $\alpha\beta\gamma\delta$.

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13. If p and q are the roots of the equation $lx^2+nx+n=0$, show that $\sqrt{\frac{p}{q}}+\sqrt{\frac{q}{p}}+\sqrt{\frac{n}{l}}=0$.

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14. If the equation $x^2+px+q=0$ and $x^2+p'x+q'=0$ have common roots, show that it must be equal to $\frac{pq'-p'q}{q-q'}$ or $\frac{q-q'}{p'-p}$.

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15. Formulate into a mathematical problem to find a number such that when its cube root is added to it, the result is 6.

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16. A 12 metre tell tree was broken into Two it was found that the height of the part which was left standing was the cube root of the length of the part that was cut away. Formulate this into a mathematical problem to find the height of the part which was cut away.

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Exercise 3 2

1. If k is real, discuss the neture of the roots of the polynomial equaion $2x^2 + x + k = 0$, in terms of k.

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2. Find a polynomial equation of minimum degree with rational coefficients, having $2 + \sqrt{3}$I as a root.

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3. Find a polynomial equation of minimum degree with rational coefficients, having 2i+3 as a root.

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4. Find a polynomial equation of minimum degree with rational coefficients, having $\sqrt{5} - \sqrt{3}$ as a root.

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5. Provet that a stralght line and parabola connot intersect at more than two points.

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Exercise 3 3

1. Solve the cubic equation : $2x^3 - x^2 - 18x + 9 = 0$ if sum of two of its roots vanishes.

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2. Solve the equation $9x^3 - 36x^2 + 44x - 16 = 0$ if the roots form an arithmetic progression.

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3. Solve the equation $3x^3 - 26x^2 + 52x - 24 = 0$ if its roots form a geometric progression.

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4. Determine k and solve the equation $2x^3 - 6x^2 + 3x + k = 0$ if one of its roots is twice the sum of the other two roots.

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5. Find all zeros of the polynomial $x^6 - 3x^5 - 5x^4 + 22x^3 - 39x^2 - 39x + 135$, if it is known that 1 + 2i and $\sqrt{3}$ are two of its zeros.

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6. Solve the cubic equation : $2x^3 - 9x^2 + 10x = 3$

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7. Solve the cubic equation : $8x^3 - 2x^2 - 7x + 3 = 0$

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8. Solve the equation : $x^4 - 14x^2 + 45 = 0$

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Exercise 3 4

1. Solve : $(x - 5)(x - 7)(x + 6)(x + 4) = 504$

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2. Solve : $(x-4)(x-7)(x-2)(x+1)=16$

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3. Solve : $(2x-1)(x+3)(x-2)(2x+3)+20=0$

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Exercise 3 5

1. Solve the equation

$\sin^2 x - 5\sin x + 4 = 0$

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2. Solve the equation

$12x^3 + 8x = 29x^2 - 4$

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3. Solve the equation

$\sin^2 x - 5\sin x + 4 = 0$

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4. Examine for the rational roots of

$2x^3 - x^2 - 1 = 0$

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5. Examine for the rational roots of

$x^8 - 3x + 1 = 0$

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6. Examine for the rational roots of

$2x^3 - x^2 - 1 = 0$

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7. Solve : $8x^{\frac{3}{2n}} - 8x^{\frac{-3}{2n}} = 63$

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8. Sove : $2\sqrt{\frac{x}{a}}+3\sqrt{\frac{a}{x}}=\frac{b}{a}+\frac{6a}{b}$

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9. Solve : $6x^4-35x^3+62x^2-35x+6=0$

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10. Solve the equations : $x^4+3x^3-3x-1=0$

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11. Solve : $6x^4 - 35x^3 + 62x^2 - 35x + 6 = 0$

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12. Find all real numbers satisfying $4^x - 3\left(2^{x+2}\right) + 2^5 = 0$

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13. Solve : $6x^4 - 35x^3 + 62x^2 - 35x + 6 = 0$

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Exercise 3 6

1. Discuss the maximum possible number of positive the negative roots of the polynomial equation $9x^9 - 4x^8 + 4x^7 - 3x^6 + 2x^5 + x^3 + 7x^2 + 7x + 2 = 0$

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2. Discuss the maximum possibel number of positive the negative zeros of the polynomials $x^2 - 5x + 6$ and $x^2 - 5x + 16$. Also draw rough sketch of the graphs.

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3. Show that the equation $x^9 - 5x^5 + 4x^4 + 2x^2 + 1 = 0$ has at least 6 imaginary solutions.

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4. Determine the number of positive and negative roots of the equation $x^9 - 5x^8 - 14x^7 = 0$.

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5. Find the exact number of real zeros and imaginary of the polynomial $x^9 + 9x^7 + 7x^5 + 5x^3 + 3x$.

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Exercise 3 7

1. A zero of $x^3 + 64$is

A. 0

B. 4

C. $4i$

D. -4

Answer:

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2. If find g are polynomials of derrees m and n respectively, and if h(x) = $(f \circ g)(x)$, then the degree of h is

A. mn

B. m+n

C. m^n

D. n^m

Answer:

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3. A polynomial equation in x of degree n always has :

A. n distince roots

B. n imaginary roots

C. at most one root

D. n real roots

Answer:

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4. If α, β and γ are the zeros of $x^3 + px^2 + qx + r$, then $\Sigma\frac{1}{\alpha}$ is

A. $-\frac{q}{r}$

B. $-\frac{p}{r}$

C. $\frac{q}{r}$

D. $-\frac{q}{p}$

Answer:

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5. According to the rational root theorem, which number is not possible rational zero of $4x^7 + 2x^4 - 10x^3 - 5$?

A. -1

B. $\frac{5}{4}$

C. $\frac{4}{5}$

D. 5

Answer:

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6. The polynomial $x^3 - kx^2 + 9x$ has three real zeros if and only if, k satifies

A. $|k| \leq 6$

B. $k = 0$

C. $|k| > 6$

D. $k| \geq 6$

Answer:

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7. The number of real numbers in $[0, 2\pi]$ satisfying $\sin^4 x - 2\sin^2 x + 1$ is .....

A. 2

B. 4

C. 1

D. $\propto$

Answer:

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8. If $x^3 + 12x^2 + 10ax + 1999$ definitely has positive zero , if and only if .....

A. $a \geq 0$

B. $a > 0$

C. $a < 0$

D. $a \leq 0$

Answer:

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9. The polynomial $x^3 + 2x + 3$ has :

A. one negative and two imaginary zeros

B. one positive the two imaginary zeros

C. three real zeros

D. no zeros

Answer:

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10. The number of positive zeros of the polynomial $\sum_{j=0}^{n}{}^{n}C_r(-1)^r x^r$ is

A. 0

B. n

C. $< n$

D. r

Answer:

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Additional Questions 1 Mark

1. If a, b, c $\in$ Q and $p + \sqrt{2}q$ (p, q $\in$ Q) is an irrational root of $ax^2 + bx + c = 0$ then the other root is

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2. The quadratic equation whose roots are α and β is

A. $(x-\alpha)(x-\beta)=0$

B. $(x-a)(x+\beta)=0$

C. $\alpha+\beta-\frac{b}{a}$

D. $\alpha\beta=\frac{-c}{a}$

Answer: A

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3. If f(x) = 0 has n roots, then f'(x) = 0 has .....roots

A. n

B. $n-1$

C. $n+1$

D. $(n-r)$

Answer: B

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4. If x is real and $k=\frac{x^2-x+1}{x^2+x+1}$ then

A. $\frac{1}{3} \leq k \leq 3$

B. $k \geq 5$

C. $k \leq 0$

D. none

Answer: A

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

A. real and negative

B. real and positive

C. retional numbers

D. none

Answer: B

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6. The equation $\sqrt{x+1}-\sqrt{x-1}=\sqrt{4x-1}$ has

A. no solution

B. one solution

C. two solution

D. more than one solution

Answer: A

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7. If the roots of the equation $x^3+bx^2+cx-1=0$ form an increasing G.P, then

A. one of the roots is 2

B. one of the roots is 1

C. one of the roots is -1

D. one of the roots is -2

Answer: B

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8. For real x, the equation $\left|\frac{x}{x-1}\right| + |x| = \frac{x^2}{|x-1|}$ has

A. one solution

B. two solution

C. at least two solution

D. no solution

Answer: C

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9. If the equation $ax^2 + bx + c = 0(a > 0)$ has two roots α and β such that α < -2 and beta > 2, then

A. $b^2 - 4ac = 0$

B. $b^2 - 4ac < 0$

C. $b^2 - 4ac > 0$

D. $b^2 - 4ac \geq 0$

Answer: C

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10. If $\left(2+\sqrt{3}\right)^{x^2-2x+1}+\left(2-\sqrt{3}\right)^{x^2-2x-1}=\frac{2}{2-\sqrt{3}}$

then x =

A. 0, 2

B. 0, 1

C. 0, 3

D. $0, \sqrt{3}$

Answer: A

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Additional Questions Fill In The Blanks

1. If α, β, γ are the roots of the equation $x^3 - 3x + 11 = 0$, then $\alpha + \beta + \gamma$ is .....

A. 0

B. 3

C. -11

D. -3

Answer: A

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2. If α, β, γ are the roots of $9x^3 - 7x + 6 = 0$, then $\alpha\beta\gamma$ is .....

A. $\frac{-7}{9}$

B. $\frac{7}{9}$

C. 0

D. $\frac{-2}{3}$

Answer: D

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3. If $x^2 - hx - 21 = 0$ and $x^2 - 3hx + 35 = 0 (h > 0)$ have a common roots, then h =.....

A. 0

B. 1

C. 4

D. 3

Answer: C

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4. If $ax^2 + bx + c = 0, a, b, c \in R$ has no real zeros, and if a + b + c + $<$ 0, then

A. $c > 0$

B. $c < 0$

C. $c = 0$

D. $c \leq 0$

Answer: B

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5. If $p(x) = ax^2 + bx + c$ and $Q(x) = -ax^2 + dx + c$ where ac $\neq$ 0 then p(x). Q(x) = 0 has at least ..... Real roots

A. no

B. 1

C. 2

D. infinite

Answer: C

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Additional Questions Choose The Incorrect Statement

1. The equation $4ax^2 + 3bx + 2c = 0$ where a, b, c are real and a+b+c = 0 has

A. two imaginary roots

B. two real roots

C. one + ve & one - ve

D. 2 -ve roots

Answer: A

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2. One root of the equation $(12x-1)(6x-1)(4x-1)(3x-1)=5$ is

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

B. $\frac{-1}{12}$

C. $\frac{7}{24}$

D. $\frac{24}{7}$

Answer: D

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3. The equation $x^4 + 2ax^3 + x^3 + 2ax + 1 = 0$ has at least two distinct negative roots is

A. $a < \frac{3}{4}$

B. $a = 1$

C. $a = -1$

D. $a = 2$

Answer: C

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4. If the equation $\left(b^2+c^2\right)x^2-2(a+b)cx+\left(c^2+a^2\right)=0$ has equal roots, then

A. a, b, c are in G.P.

B. $c^2=ab$

C. a, b, c, are in G.P.

D. $c=\sqrt{ab}$

Answer: A

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5. The values of x which satich satisty the equation $\left|x^2+3x\right|+x^2-2=0$ are .....

A. $\frac{-2}{2}$

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

C. $\frac{2}{3}$

D. $\frac{-2}{3}, \frac{1}{2}$

Answer: C

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Additional Questions

1. CHOOSE THE ADD MAN OUT :

A. $x + \frac{1}{2} = 2$

B. $ax^2 + bx + c = 0$

C. $\sqrt{x} + \frac{1}{\sqrt{x}} = 4$

D. $ax^2 + \frac{b}{x} + c = 0$

Answer: D

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2. CHOOSE THE ADD MAN OUT :

A. $2x^2 + 7x - 2x + 7 = 0$

B. $6x^2 - 6x^3 + 5 = 0$

C. $-5 + 6x + 5x^2 - 6x^3 = 0$

D. $9x^4 - 5x^3 + 5x^2 - 9 = 0$

Answer: B

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Additional Questions Choose The Add Man Out

1. CHOOSE THE ADD MAN OUT :

A. $\left(\frac{3}{5}\right)^x = x - x^2 - 9$

B. $\sin x = 4$

C. `tan x = 1

D. $\cos x = 7$

Answer: C

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2. If $c \neq 0$ and $\frac{p}{2x} = \frac{a}{x+c} + \frac{b}{x-c}$ has two equal roots, then find p.

A. $p = \left(\sqrt{a} - \sqrt{b}\right)^2$

B. $\left(\sqrt{a} + \sqrt{b}\right)^2$

C. $\left(\sqrt{a} \pm \sqrt{b}\right)^2$

D. 0

Answer: D

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3. If $ax + by = 1, cx^2 + dy^2 = 1$ have only one solution, then $\frac{a^2}{c} + \frac{b^2}{d} = 1$ and $x = \frac{a}{c}, y = \frac{b}{d}$

A. $\frac{a^2}{c} + \frac{b^2}{d} = 1$

B. $x = \frac{a}{c}$

C. $x = \frac{c}{a}$

D. $y = \frac{b}{d}$

Answer: C

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Additional Questions Match The Following

1. For the cubic equation $x^3 + ax^2 + bx + c = 0$

The Correct match is

A.
i	ii	iii	iv
a	b	c	d

B.
i	ii	iii	iv
b	c	d	a

C.
i	ii	iii	iv
b	c	a	d

D.
i	ii	iii	iv
c	d	b	a

Answer: B

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2. For the equation $4x^2 + 4px + p2 = 0$

The Correct match is.

A.
i	ii	iii	iv
c	a	b	d

B.
i	ii	iii	iv
c	b	d	a

C.
i	ii	iii	iv
c	a	d	b

D.
i	ii	iii	iv
d	a	b	c

Answer: C

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3.

The Correct match is

A. $\begin{matrix} i & ii & iii & iv \\ b & c & d & a \end{matrix}$

B. $\begin{matrix} i & ii & iii & iv \\ a & b & c & d \end{matrix}$

C. $\begin{matrix} i & ii & iii & iv \\ b & c & a & d \end{matrix}$

D. $\begin{matrix} i & ii & iii & iv \\ c & c & a & d \end{matrix}$

Answer: A

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4.

The Correct match is.

A.
i	ii	iii	iv
a	d	b	c

B.
i	ii	iii	iv
b	c	d	a

C.
i	ii	iii	iv
c	a	b	d

D.
i	ii	iii	iv
d	c	d	a

Answer: D

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5. 

The Correct match is.

A.
i	ii	iii	iv
b	c	a	d

B.
i	ii	iii	iv
c	b	a	d

C. $\begin{matrix} i & ii & iii & iv \\ a & b & c & d \end{matrix}$

D. $\begin{matrix} i & ii & iii & iv \\ b & c & d & a \end{matrix}$

Answer: D

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2 Marks

1. If $\sin\alpha, \cos\alpha$ are the roots of the equation $ax^2 + bx + c = 0 (c \neq 0)$, then prove that $(a + c)^2 = b^2 + c^2$.

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2. Find value of a for which the sum of the squares of the equation $x^2 - (a-2)x - a - 1 = 0$ assumes the least value.

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3. Find the interval for a for which $3x^2 + 2(a^2+1)x + (a^2 - 3a + 2)$ possesses roots of opposite sign.

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4. Find x if $x = \sqrt{2 + \sqrt{2 + \sqrt{+ \ldots + \text{upto} \infty}}}$

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5. Find the number of positive and negative roots of the equation $x^7 - 6x^6 + 7x^5 + 5x^2 + 2x + 2$

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3 Marks

1. Find the number of real solutions of $\sin(e^x) = 5^x + 5^{-x}$.

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2. Find the number of positive integreal solutions of (pairs of positive integers satisfying) $x^2 - y^2 = 353702.$

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3. Solve : $2^x + 2^{x-1} + 2^{x-2} = 7^x + 7^{x-1} + 7^{x-2}$

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4. Solve : $(x-1)^4 + (x-5)^4 = 82$

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5. Solve : $\left(5+2\sqrt{6}\right)^{x^2-3}+\left(5-2\sqrt{6}\right)^{x^2-3}=10$

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4 Marks

1. If the sum of the roots of the quadratic equation $ax^2+bx+c=0$ (abc $\neq$ 0) is equal to the sum of the squares of their reciprocals, the sum of the squares of their reciprocals, then $\frac{a}{c}, \frac{b}{a}, \frac{c}{b}$ are in H.P.

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2. If a, b, d and p are distinct non - zero real numbers such that $(a^2+b^2+c^2)p^2-2(ab+bc+cd)p+\left(b^2+c^2+d^2\right)\leq 0$ then n. Prove that a, b, c, d are in G. P and ad = bc

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3. If $c\neq 0$ and $\frac{p}{2x}=\frac{a}{x+c}+\frac{b}{x-c}$ has two equal roots, then find p.

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4. If the equation $x^2+bx+ca=0$ and $x^2+cx+ab=0$ have a common root and $b\neq c$, then

prove that their roots will satisfy the equation $x^2 + ax + bc = 0$.

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5. Solve : $\left(2x^2 - 3x + 1\right)\left(2x^2 + 5x + 1\right) = 9x^2$.

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