MATHS

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THEORY OF EQUATIONS

Single correct Answer

1. Number of real solutions of $\sqrt{2x-4}-\sqrt{x+5}=1$ is

A. 0

B. 1

C. 2

D. infinite

Answer: B

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2. Number of real solutions of $\sqrt{x}+\sqrt{x-\sqrt{1-x}}=1$ is (a) 0 (b) 1 (c) 2 (d) infinite

A. 0

B. 1

C. 2

D. infinite

Answer: B

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3. The set of real values of a for which the equation $\frac{2a^2+x^2}{a^3-x^3}-\frac{2x}{ax+a^2+x^2}+\frac{1}{x-a}=0$ has a unique solution is (a) (−∞,1) (b) (−1,∞) (c) (-1,1) (d) R−{0}

A. $(-\infty, 1)$

B. $(-1, \infty)$

C. $(-1, 1)$

D. $R - \{0\}$

Answer: D

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4. Number of distinct real solutions of the equation $x^2 + \left(\frac{x}{x-1}\right)^2 = 8$ is (a) 1 (b) 2 (c)3 (d)4

A. 1

B. 2

C. 3

D. 4

Answer: C

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5. If m, n are positive integers and $m+n\sqrt{2}=\sqrt{41+24\sqrt{2}}$, then $(m+n)$ is equal to (a) 5 (b) 6 (c) 7 (d) 8

A. 5

B. 6

C. 7

D. 8

Answer: C

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6. The equation $\left(x+3-4(x-1)^{1/2}\right)^{1/2}+\left(x+8-6(x-1)^{1/2}\right)^{1/2}=1$ has (A) no solution (B) only 1 solution (C) only 2 solutions (D) more than 2 solutions

A. no solution

B. only 1 solution

C. only 2 solutions

D. more than 2 solutions

Answer: D

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7. The number of solutions of $\sqrt{3x^2+x+5}=x-3$ is (A) 0 (B) 1 (C) 2 (D) 4

A. 0

B. 1

C. 2

D. 4

Answer: A

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8. The number of real solutions of $x^2 - 6|x| + 8 = 0$ is

A. 6

B. 4

C. 2

D. 0

Answer: A

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9. If α, β ar the roots of the quadratic equation $x^2 - \left(3 + 2^{\sqrt{\log_2 3}} - 3^{\sqrt{\log_3 2}}\right)x - 2\left(3^{\log_3 2} - 2^{\log_z 3}\right) = 0$, then the value of $\alpha^2 + \alpha\beta + \beta^2$ is equal to :

A. 11

B. 7

C. 3

D. 5

Answer: B

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10. Which of the following is not true for equation $x^2 \log 8 - x \log 5 = 2(\log 2) - x$ (A) equation has one integral root (B) equation has no irrational roots (C) equation has rational roots (D) none of these

A. equation has one integral root

B. equation has no irrational roots

C. equation has rational roots

D. none of these

Answer: D

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11. Let $f(x)$ be a quadratic expression such that $f(-1)+f(2)=0$. If one root of $f(x)=0$ is 3, then the other root of $f(x)=0$ lies in (A) $(-\infty, -3)$ (B) $(-3, \infty)$ (C) $(0, 5)$ (D) $(5, \infty)$

A. $(-\infty, -3)$

B. $(-3, \infty)$

C. $(0, 5)$

D. $(5, \infty)$

Answer: B

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12. If $f(x)=\left(x^2+3x+2\right)\left(x^2-7x+a\right)$ and $g(x)=\left(x^2-x-12\right)\left(x^2+5x+b\right)$, then the value of a and b, if

$(x+1)(x-4)$ is H.C.F. of $f(x)$ and $g(x)$ is (a) a=10 : b=6(b)a=4 : b=12(c) a=12 : b=4(d)a=6 : b=10`

A. $a = 10 : b = 6$

B. $a = 4 : b = 12$

C. $a = 12 : b = 4$

D. $a = 6 : b = 10$

Answer: C

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13. The remainder obtained when the polynomial $x + x^3 + x^9 + x^{27} + x^{81} + x^{243}$ is divided by $x^2 - 1$ is

(a)6x+1 (b)5x+1 (c)4x (d)6x

A. $6x + 1$

B. $5x + 1$

C. $4x$

D. $6x$

Answer: B

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14. Let $f(x) = x^2 - ax + b$, $'a'$ is odd positive integar and the roots of the equation $f(x) = 0$ are two distinct prime numbers. If $a + b = 35$, then the value of $f(10) =$

A. -8

B. -10

C. -4

D. 0

Answer: A

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15. If $0 < \alpha < \beta < \gamma < \pi/2$, then the equation

$$(x - \sin\beta)(x - \sin\gamma) + (x - \sin\alpha)(x - \sin\gamma) + (x - \sin\alpha)(x - \sin\beta)$$

has

A. real and unequal roots

B. non-real roots

C. real and equal roots

D. real and unequal roots greater than 2

Answer: A

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16. If the system of equation $r^2 + s^2 = t$ and $r + s + t = \frac{k-3}{2}$ has exactly one real solution, then the value of k is

A. 1

B. 2

C. 3

D. 4

Answer: B

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17. If $a, \quad b, \quad c \in R$ and $3b^2 - 8ac < 0,$ then the equation $ax^4 + bx^3 + cx^2 + 5x - 7 = 0$ has a) all real roots b) all imaginary roots c)exactly two real and two imaginary roots d) none

A. all real roots

B. all imaginary roots

C. exactly two real and two imaginary roots

D. none

Answer: C

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18. For real solution of equation $3\sqrt{x+3p+1}-3\sqrt{x}=1$, we have

A. $p \geq 1/4$

B. $p \geq -1/4$

C. $p \geq 1/3$

D. $p \geq -1/3$

Answer: B

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19. For a, b,c non-zero, real distinct, the equation, $(a^2+b^2)x^2-2b(a+c)x+b^2+c^2=0$ has non-zero real roots. One of these roots is also the root of the equation :

A. $(b^2-c^2)x^2+2a(b-c)x-a^2=0$

B. $(b^2+c^2)x^2-2a(b+c)x+a^2=0$

C. $a^2x^2 + a(c-b)x - bc = 0$

D. $a^2x^2 - a(b-c)x + bc = 0$

Answer: C

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20. The equation $x^2 + bx + c = 0$ has distinct roots. If 2 is subtracted from each root the result are the reciprocal of the original roots, then $b^2 + c^2$ is

A. 2

B. 3

C. 4

D. 5

Answer: D

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21. The equation $\left(x^2 + 3x + 4\right)^2 + 3\left(x^2 + 3x + 4\right) + 4 = x$ has a.all its solutions real but not all positive b.only two of its solutions real c. two of its solutions positive and negative d. none of solutions real

A. all its solutions real but not all positive

B. only two of its solutions real

C. two of its solutions positive and negative

D. none of solutions real

Answer: D

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22. If one root of the equation $(x-1)(7-x) = m$ is three times the other, then m is equal to

A. -5

B. 0

C. 2

D. 5

Answer: C

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23. If the roots of the equation $ax^2 - 4x + a^2 = 0$ are imaginery and the sum of the roots is equal to their product then a is

A. -2

B. 4

C. 2

D. none of these

Answer: C

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24. The value of α, for which the equation $x^2 - (\sin\alpha - 2)x - (1 + \sin\alpha) = 0$ has root whose sum of square is least, is

A. $\pi/4$

B. $\pi/3$

C. $\pi/2$

D. $\pi/6$

Answer: C

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25. If α and β are the roots of the equation $ax^2 + bx + c = 0$ then the sum of the roots of the equation $a^2x^2 + (b^2 - 2ac)x + b^2 - 4ac = 0$ is

A. $-(\alpha^2 - \beta^2)$

B. $(\alpha+\beta)^2-2\alpha\beta$

C. $\alpha^2\beta+\beta\alpha^2-4\alpha\beta$

D. $-\left(\alpha^2+\beta^2\right)$

Answer: D

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26. If the roots of the quadratic equation $ax^2+bx-b=0$, where a, $b \in R$ such that $a \cdot b > 0$, are α and β, then the value of $\log_{|(\beta-1)|}|(\alpha-1)|$ is

A. (a) 1

B. (b) -1

C. (c) 0

D. (d) none of these

Answer: B

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27. If $\cos^4 \alpha + k$ and $\sin^4 \alpha + k$ are the roots of $x^2 + \lambda(2x + 1) = 0$ and $\sin^2 \alpha + 1$ and $\cos^2 \alpha + 1$ are the roots of $x^2 + 8x + 4 = 0$, then the sum of the possible values of λ is

A. 2

B. -1

C. 1

D. 3

Answer: C

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28. Let $f(x) = ax^2 + bx + c, g(x) = ax^2 + qx + r$, where $a, b, c, q, r \in R$ and $a < 0$. If α, β are the roots of $f(x) = 0$ and $\alpha + \delta, \beta + \delta$ are the roots of $g(x) = 0$, then

A. $f_{\max} > g_{\max}$

B. $f_{\max} < g_{\max}$

C. $f_{\max} = g_{\max}$

D. cant say anything about relation between $f_{\max}$ and $g_{\max}$

Answer: C

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29. If a, b, c are in geometric progresion and the roots of the equations $ax^2 + 2bx + c = 0$ are α and β and those of $cx^2 + 2bx + a = 0$ are γ and δ then

A. $\alpha \neq \beta \neq \gamma \neq \delta$

B. $\alpha \neq \beta$ and $\gamma \neq \delta$

C. $a\alpha = a\beta = c\gamma = c\delta$

D. $\alpha = \beta, \gamma \neq \delta$

Answer: C

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30. If α, β are the roots of the equation $ax^2 + bx + c = 0$ and $S_n = \alpha^n + \beta^n$, then $aS_{n+1} + bS_n + cS_{n-1} = (n \geq 2)$

A. 0

B. $a + b + c$

C. $(a + b + c)n$

D. n^2abc

Answer: A

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31. Let $f(x) = ax^2 + bx + c$, $g(x) = ax^2 + qx + r$, where a, b, c,q, $r \in R$ and $a < 0$. If α, β are the roots of $f(x) = 0$ and $\alpha + \delta$, $\beta + \delta$ are the roots of $g(x) = 0$, then

A. α will be $A.\ M.$ of the roots of $f(x) = 0, g(x) = 0$

B. α will be $G.\ M.$ of the roots of $f(x) = 0, g(x) = 0$

C. α will be $A.\ M.$ of the roots of $f(x) = 0$ or $g(x) = 0$

D. α will be $G.\ M.$ of the roots of $f(x) = 0$ or $g(x) = 0$

Answer: A

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32. If α and β be the roots of equation $x^2 + 3x + 1 = 0$ then the value of $\left(\frac{\alpha}{1+\beta}\right)^2 + \left(\frac{\beta}{1+\alpha}\right)^2$ is equal to

A. 18

B. 19

C. 20

D. 21

Answer: A

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33. The roots of the equation $a(b-2c)x^2+b(c-2a)x+c(a-2b)=0$ are, when $ab+bc+ca=0$

A. 1, $\dfrac{c(a-2b)}{a(b-2c)}$

B. $\dfrac{c}{a}, \dfrac{a-2b}{b-2c}$

C. $\dfrac{a-2b}{a-2c}, \dfrac{a-2b}{b-2c}$

D. none of these

Answer: A

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34. If the equations $2x^2-7x+1=0$ and $ax^2+bx+2=0$ have a common root, then

A. $a = 2, b = -7$

B. $a = \frac{-7}{2}, b = 1$

C. $a = 4, b = -14$

D. $a = -4, b = 1$

Answer: C

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35. If $\alpha and \beta, \alpha and \gamma, \alpha and \delta$ are the roots of the equations $ax^2 + 2bx + c = 0, 2bx^2 + cx + a = 0 adn cx^2 + ax + 2b = 0,$ respectively, where a, b, and c are positive real numbers, then $\alpha + \alpha^2 =$ abc b. $a + 2b + c$ c. -1 d. 0

A. -1

B. 1

C. 0

D. abc

Answer: A

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36. The product of uncommon real roots of the polynomials $p(x) = x^4 + 2x^3 - 8x^2 - 6x + 15$ and $q(x) = x^3 + 4x^2 - x - 10$ is :

A. -6

B. -5

C. 5

D. 6

Answer: D

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37. Number of values of x satisfying the pair of quadratic equations $x^2 - px + 20 = 0$ and $x^2 - 20x + p = 0$ for some $p \in R$ is

A. A. 0

B. B. 1

C. C. 2

D. D. 3

Answer: D

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38. If the equation $4x^2 - x - 1 = 0$ and $3x^2 + (\lambda + \mu)x + \lambda - \mu = 0$ have a root common, then the irrational values of λ and μ are a $\lambda = \frac{-3}{4}$ b. $\lambda = 0$ c. $\mu = \frac{3}{4}$ b.$\mu = 0$

A. $\lambda = 0, \mu = \frac{-3}{4}$

B. $\lambda = \frac{-3}{4}, \mu = \frac{3}{4}$

C. $\lambda = \frac{-3}{4}, \mu = 0$

D. $\lambda = \frac{-3}{4}, \mu = \frac{1}{4}$

Answer: C

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39. If the equations $x^2 + 2\lambda x + \lambda^2 + 1 = 0, \quad \lambda \in R$ and $ax^2 + bx + c = 0$, where a, b, c are lengths of sides of triangle have a common root, then the possible range of values of λ is

A. A. $(0, 2)$

B. B. $(\sqrt{3}, 3)$

C. C. $(2\sqrt{2}, 3\sqrt{2})$

D. D. $(0, \infty)$

Answer: A

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40. If both the roots of $\lambda(6x^2+3)+rx+2x^2-1=0$ and $6\lambda(2x^2+1)+px+4x^2-2=0$ are common, then $2r-p$ =?

A. -1

B. 0

C. 1

D. 2

Answer: B

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41. $x^3+5x^2+px+q=0$ and $x^3+7x^2+px+r=0$ have two roos in common. If their third roots are γ_1 and γ_2 , respectively, then $|\gamma_1+\gamma_2|=$?

A. 10

B. 12

C. 13

D. 42

Answer: B

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42. Let $a, b \in N, a \neq b$ and the two quadratic equations $(a-1)x^2 - (a^2+2)x + a^2 + 2a = 0$ and $(b-1)x^2 - (b^2+2)x + (b^2 +$

have a common root. The value of ab is

A. 4

B. 6

C. 8

D. `10

Answer: C

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43. A quadratic equations $p(x) = 0$ having coefficient x^2 unity is such that $p(x) = 0$ and $p(p(p(x))) = 0$ have a common root, then

A. A. $p(0)p(1) > 0$

B. B. $p(0)p(1) < 0$

C. C. $p(0)p(1) = 0$

D. D. $p(0) = 0$ and $p(1) = 0$

Answer: C

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44. If $ax^2 + bx + c$=0 and $cx^2 + bx + a$=0 $(a, b, c \in R)$ have a common non-real roots,then

A. $-2|a| < |b| < |a|$

B. $-2|c| < b < 2|c|$

C. $a = c$

D. None of these

Answer: D

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45. Consdier the equaiton $2 + \ | x^2 + 4x + 2_{=} m, m \in R$

Set of all real values of m so that given equation have four distinct solutions, is

A. 5

B. 6

C. 7

D. 8

Answer: C

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46. If the equation $\left|x^2 - 5x + 6\right| - \lambda x + 7\lambda = 0$ has exactly 3 distinct solutions then λ is equal to

A. $-7 + \sqrt{23}$

B. $-9 + 4\sqrt{5}$

C. $-7 - \sqrt{23}$

D. $-9 - 4\sqrt{5}$

Answer: B

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47. Let $\alpha, \beta (a < b)$ be the roots of the equation $ax^2 + bx + c = 0$. If $\lim_{x \to \alpha} \frac{\left|ax^2 + bx + c\right|}{ax^2 + bx + c} = 1$ then

A. $\frac{|a|}{a} = -1$,

B. $a > 0$,

C. $\frac{|a|}{a} = 1$,

D. $a < 0$,

Answer: C

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48. If the quadratic polynomials defined on real coefficient $P(x) = a_1x^2 + 2b_1x + c_1$ and $Q(x) = a_2x^2 + 2b_2x + c_2$ take positive values $\forall x \in R$, what can we say for the trinomial $g(x) = a_1a_2x^2 + b_1b_2x + c_1c_2$?

A. $g(x)$ takes positive values only.

B. $g(x)$ takes negative values only.

C. $g(x)$ can takes positive as well as negative values.

D. Nothing definite can be said about $g(x)$.

Answer: A

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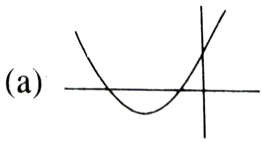
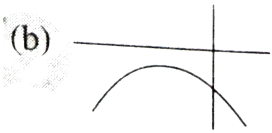
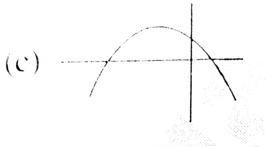
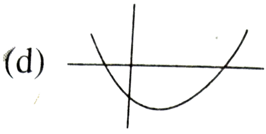
49. For which of the following graphs the quadratic expression $y = ax^2 + bx + c$ the product abc is negative ?

A. 

B. 

C. 

D. 

Answer: B

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50. The difference of maximum and minimum value of $\frac{x^2 + 4x + 9}{x^2 + 9}$ is

A. $1/3$

B. $2/3$

C. $-2/3$

D. $4/3$

Answer: D

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51. If $a > 1$, then the roots of the equation $(1 - a)x^2 + 3ax - 1 = 0$ are

A. one positive and one negative

B. both negative

C. both positive

D. both non real complex

Answer: C

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52. All the values of $'a'$ for which the quadratic expression $ax^2 + (a-2)x - 2$ is negative for exactly two integral values of x may lie in (a) $\left[1, \frac{3}{2}\right]$ (b) $\left[\frac{3}{2}, 2\right)$ (c) $[1, 2)$ (d) $[-1, 2)$

A. $[-1, 1]$

B. $[1, 2)$

C. $[-1, 1]$

D. `[-2,-1])

Answer: B

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53. If $a > 1$, then the roots of the equation $(1 - a)x^2 + 3ax - 1 = 0$ are

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54. The equation $ax^4 - 2x^2 - (a - 1) = 0$ will have real and unequal roots if

A. $o < a < 1$

B. $a > 0, a \neq 1$

C. $a < 0 , a \neq 1$

D. none of these

Answer: A

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55. If $ax^2+bx+c=0, a \neq 0, a, b, c \in R$ has distinct real roots in $(1, 2)$, then a and $5a+2b+c$ have (a) same sign (b) opposite sign (c) not determined (d) none of these

A. same sign

B. opposite sign

C. not determined

D. none of these

Answer: A

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56. If $c < a < b < d$, then roots of the equation $bx^2+(1-b(c+d)x+bcd-a=0$

A. are real and one lies between c and a

B. are real and distinct in which one lies between a and b

C. are real and distinct in which one lies between c and d

D. are not real

Answer: C

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57. If $2a, b, 2c$ are in $A.P.$ where a, b, c are R^{+}, then the expression $f(x)=\left(ax^2-bx+c\right)$ has

A. both roots negative

B. both roots positive

C. atleast one root between 0 and 2

D. roots are of opposite sign.

Answer: B

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58. If a, b, c are positive numbers such that $a > b > c$ and the equation $(a+b-2c)x^2 + (b+c-2a)x + (c+a-2b) = 0$ has a root in the interval $(-1, 0)$, then

A. b cannot be the $G.M.$ of a,c

B. b may be the $G.M.$ of a,c

C. b is the $G.M.$ of a,c

D. none of these

Answer: A

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59. If the quadratic equation $x^2 - 36x + \lambda = 0$ has roots α and β such that $\alpha, \beta \in N$ and $\frac{\lambda}{5} \notin Z$ and λ assumes minimum possible value then $\frac{\sqrt{\alpha+2}\sqrt{\beta+2}}{|\alpha-\beta|}$ is equal to (a) $\frac{3}{8}$ (b) $\frac{3}{16}$ (c) $\frac{\sqrt{111}}{34}$ (d) $\frac{\sqrt{111}}{17}$

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

B. $\frac{3}{16}$

C. $\frac{\sqrt{111}}{34}$

D. $\frac{\sqrt{111}}{17}$

Answer: A

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60. If the equation $2^{2x} + a \cdot 2^{x+1} + a + 1 = 0$ has roots of opposite sign, then the exhaustive set of real values of a is (a)(−∞,0) (b)(−1,−2/3) (c)(−∞,−2/3) (d)(−1,∞)

A. $(-\infty, 0)$

B. $\left(-1, \frac{-2}{3}\right)$

C. $\left(-\infty, \frac{-2}{3}\right)$

D. $(-1, \infty)$

Answer: B

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61. Let a, b, c ne three distinct non-zero real numbers satisfying the system of equation $\frac{1}{a}+\frac{1}{a-1}+\frac{1}{a-2}=1$, $\frac{1}{b}+\frac{1}{b-1}+\frac{1}{b-2}=1$, $\frac{1}{c}+\frac{1}{c-1}+\frac{1}{c-2}=1$. Then $abc=$ (a) 1 (b)2 (c)3 (d)4

A. 1

B. 2

C. 3

D. 4

Answer: B

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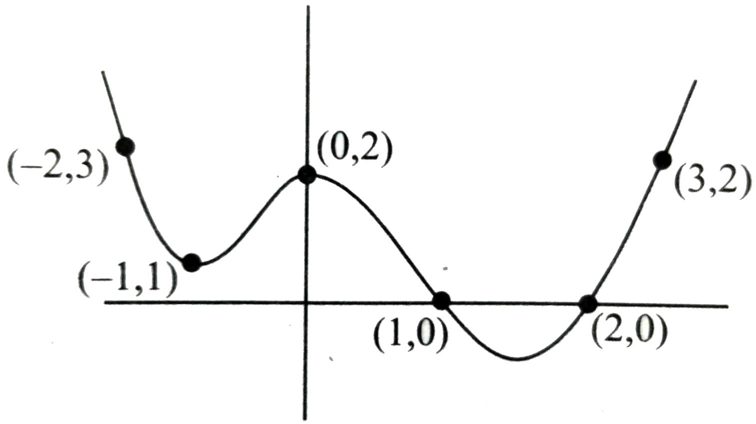
62. In the given figure graph of $y=p(x)=x^4+ax^3+bx^2+cx+d$ is given



The product of all imaginary roots of $p(x) = 0$ is (a) 1 (b) 2 (c) $\frac{1}{3}$ (d) $\frac{1}{4}$

A. 1

B. 2

C. $1/3$

D. $1/4$

Answer: A

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63. If $a^3 - 3a^2 + 5a - 17 = 0$ and $b^3 - 3b^2 + 5b + 11 = 0$ are such that $a + b$ is a real number, then the value of $a + b$ is

A. -1

B. 1

C. 2

D. -2

Answer: C

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64. Let $f(x) = x^4 + ax^3 + bx^2 + cx + d$ be a polynomial with real coefficients and real roots. If |f(i)|=1where $i = \sqrt{-1}$, then the value of a +b+c+d is

A. -1

B. 1

C. 0

D. can't be determined

Answer: C

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65. If f(x) is a polynomial of degree four with leading coefficient one satisfying $f(1)=1, f(2)=2, f(3)=3$.then $\left[\frac{f(-1)+f(5)}{f(0)+f(4)}\right]$

A. 4

B. 5

C. 6

D. 7

Answer: B

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66. Let $P(x)=x^6-x^5-x^3-x^2-x$ and $\alpha, \beta, \gamma, \delta$ are the roots of the equation $x^4-x^3-x^2-1=0,$ then

$P(\alpha) + P(\beta) + P(\gamma) + P(\delta) =$

A. 4

B. 6

C. 8

D. 12

Answer: B

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67. The line $y = mx + 1$ touches the curves $y = -x^4 + 2x^2 + x$ at two points $P(x_1, y_1)$ and $Q(x_2, y_2)$. The value of $x_1^2 + x_2^2 + y_1^2 + y_2^2$ is

A. 4

B. 6

C. 8

D. 10

Answer: B

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68. If $a+2b+3c=4$, then find the least value of $a^2+b^2+c^2$.

A. -2

B. 2

C. 8

D. -14

Answer: D

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69. If the roots of $x^4+qx^2+kx+225=0$ are in arthmetic progression, then the value of q, is

A. 15

B. 25

C. 35

D. -50

Answer: D

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Comprehension

1. Let $P(x)$ be a polynomial of degree at most 5 which leaves remainders -1 and 1 upon divison by $(x-1)^3$ and $(x+1)^3$, respectively.

The sum of pairwise product of all roots (real and complex) of $P(x)=0$ is

A. 1

B. 3

C. 5

D. 2

Answer: A

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2. p(x) be a polynomial of degree at most 5 which leaves remainder - 1 and 1 upon division by $(x-1)^3$ and $(x+1)^3$respectively, the number of real roots of $P(x)=0$ is

A. $-\frac{5}{3}$

B. $-\frac{10}{3}$

C. 2

D. -5

Answer: B

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3. Let $f(x) = ax^2 + bx + c$, $a \neq 0$, a, b, $c \in I$. Suppose that $f(1) = 0$, $50 < f(7) < 60$ and $70 < f(8) < 80$.

The least value of $f(x)$ is

A. $3/4$

B. $9/2$

C. $-9/8$

D. $3/4$

Answer: C

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4. Let $f(x) = ax^2 + bx + c$, $a \neq 0$, a, b, $c \in I$. Suppose that $f(1) = 0$, $50 < f(7) < 60$ and $70 < f(8) < 80$.

The least value of $f(x)$ is

A. 0

B. 1

C. 2

D. 3

Answer: B

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5. Let α, β be two real numbers satisfying the following relations

$\alpha^2 + \beta^2 = 5, 3(\alpha^5 + \beta^5) = 11(\alpha^3 + \beta^3)$

Quadratic equation having roots α and β is

A. 2

B. $-\dfrac{10}{3}$

C. -2

D. $\dfrac{10}{3}$

Answer: A

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6. Let α, β be two real numbers satisfying the following relations $\alpha^2 + \beta^2 = 5, 3(\alpha^5 + \beta^5) = 11(\alpha^3 + \beta^3)$

Quadratic equation having roots α and β is

A. ± 2

B. ± 3

C. ± 1

D. $\pm \sqrt{3}$

Answer: B

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7. Let α, β be two real numbers satisfying the following relations $\alpha^2 + \beta^2 = 5, 3(\alpha^5 + \beta^5) = 11(\alpha^3 + \beta^3)$

Quadratic equation having roots α and β is

A. (a) $x^2 \pm x + 2 = 0$

B. (b) $x^2 \pm 3x - 2 = 0$

C. (c) $x^2 \pm \sqrt{3}x + 2 = 0$

D. (d) none of these

Answer: D

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8. Consider quadratic equations $x^2 - ax + b = 0$ and $x^2 + px + q = 0$

If the above equations have one common root and the other roots are reciprocals of each other, then $(q - b)^2$ equals

A. $bq(p - a)^2$

B. $b(p - a)^2$

C. $q(p - a)^2$

D. none of these

Answer: A

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9. Consider quadratic equations $x^2 - ax + b = 0..........(i)$ and $x^2 - px + q = 0..........(ii)$

If for the equations (i) and (ii), one root is common and the equation (ii) have equal roots, then $b + q$ is equal to

A. $-ap$

B. ap

C. $-\frac{1}{2}ap$

D. $2ap$

Answer: C

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10. Consider quadratic equations $x^2 - ax + b = 0$..........(i) and $x^2 - px + q = 0$..........(ii)

If for the equations (i) and (ii) , one root is common and the equation (ii) have equal roots, then $b + q$ is equal to

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11. The polynomial $P(x) = x^3 + ax^2 + bx + c$ has the property that the mean of its roots, the product of its roots, and the sum of its coefficients are all equal. If the y-intercept of the graph of $y = P(x)$ is 2,

The value of b is

A. -11

B. -9

C. -7

D. 5

Answer: A

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12. The polynomial $P(x) = x^3 + ax^2 + bx + c$ has the property that the mean of its roots, the product of its roots, and the sum of its coefficients are all equal. If the y-intercept of the graph of $y = P(x)$ is 2,

The value of $P(1)$ is

A. 0

B. -1

C. 2

D. -2

Answer: D

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Multiple Correct Answer

1. If $c \neq 0$ and the equation $p/(2x) = a/(x+c) + b/(x-c)$ has two equal roots, then p can be a. $(\sqrt{a} - \sqrt{b})^2$ b. $(\sqrt{a} + \sqrt{b})^2$ c. $a + b$ d. $a - b$

A. $(\sqrt{a} - \sqrt{b})^2$

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

C. $a + b$

D. $a - b$

Answer: A::B

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2. The equation $(ay - bx)^2 + 4xy = 0$ has rational solutions x, y for

A. $a = \frac{1}{2}, b = 2$

B. $a = 4, b = \frac{1}{8}$

C. $a = 1, b = \frac{3}{4}$

D. $a = 2, b = 1$

Answer: A::C

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3. Let a, b, c and $m \in R^+$. The possible value of m (independent of a, b and c) for which atleast one of the following equations have real roots is

$$\left.\begin{array}{l} ax^2 + bx + cm = 0 \\ bx^2 + cx + am = 0 \\ cx^2 + ax + bm = 0 \end{array}\right\}$$

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

B. $\frac{1}{8}$

C. $\frac{1}{12}$

D. $\frac{1}{4}$

Answer: B::C::D

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4. If α, β, γ are the roots of the equation $9x^3 - 7x + 6 = 0$ then the equation $x^3 + Ax^2 + Bx + C = 0$ has roots $3\alpha + 2,\ 3\beta + 2,\ 3\gamma + 2,$ where

A. $A = 6$

B. $B = -5$

C. $C = 24$

D. $A + B + C = 23$

Answer: C::D

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5. Let $'m'$ be a real number, and suppose that two of the three solutions of the cubic equation $x^3 + 3x^2 - 34x = m$ differ by 1. Then possible value of $'m'$ is/are

A. (a) 120

B. (b) 80

C. (c) -48

D. (d) -32

Answer: A::C

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6. Let $f(x)=x^3+x+1$, let $p(x)$ be a cubic polynomial such that the roots of $p(x)=0$ are the squares of the roots of $f(x)=0$, then

A. $p(1)=3$

B. the value of $P(n), n \in N$ is odd

C. Sum of all roots of $p(x)=0$ is -2

D. Sum of all product of roots taken two at a time is 1

Answer: A::B::C::D

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ILLUSTRATION

1. f(x) be a quadratic polynomial $f(x) = (x-1)(ax+b)$ satisfying $f(2) + f(4) = 0.$

If unity is one root of f(x) = 0 then find the other root.

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2. A polynomial in x of degree 3 vanishes when $x = 1$ and $x = -2$, ad has the values 4 and 28 when $x = -1$ and $x = 2$, respectively. Then find the value of polynomial when $x = 0$.

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3. Let $f(x) = Ax^2 + Bx + c, where A, B, C$ are real numbers. Prove that if $f(x)$ is an integer whenever x is an integer, then the numbers $2A, A+B, and C$ are all integer. Conversely, prove that if the number

$2A, A+B, and C$ are all integers, then $f(x)$ is an integer whenever x is integer.

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4. Prove that

$$\frac{ax^2}{(x-a)(x-b)(x-c)}+\frac{bx}{(x-b)(x-c)}+\frac{c}{x-c}+1$$
$$=\frac{x^3}{(x-a)(x-b)(x-c)}.$$

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5. Find the remainder when $2x^2+7x^2-x+8$ is divided by $x-1.$

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6. If the expression $ax^4+bx^3-x^2+2x+3$ has remainder $4x+3$ when divided by $x^2+x-2,$ find the value of $a and b.$

Watch Video Solution

7. Let a $\neq$ 0 and P(x) be a polynomial of degree greater then 2.If P(x) leaves remianders a and a- when divided, respectively, by x + a and x - a, then find the remainder when P(x) is divided by $x^2 - a^2$.

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8. Given that $x^2 + x - 6$ is a factor of $2x^4 + x^3 - ax^2 + bx + a + b - 1$, find the value of a and b.

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9. Use the factor theorem to find the value of k for which $(a + 2b), wherea, b \neq 0$ is a factor of $a^4 + 32b^4 + a63b(k + 3)$.

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10. If c, d are the roots of the equation $(x-a)(x-b)-k=0$, prove that a, b are roots of the equation $(x-c)(x-d)+k=0.$

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11. Let $f(x) = x^3 + x + 1$ and P(x) be a cubic polynomial such that P(0) = -1 and roots of f(0) = 1 ; P(x) = 0 are the squares of the roots of f(x) = 0 . Then find the value of P(4).

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12. Let f(x) be a polynomial with integral coefficients. If f(1) and f(2) both are odd integers, prove that f(x) = 0 can' t have any integral root.

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13. Let $a, b \in N$ and $a > 1.$ Also p is a prime number. If $ax^2 + bx + c = p$ for any intergral values of $x,$ then prove that $ax^2 + bx + c \neq 2p$ for any integral value of $x\cdot$

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14. If $(a^2 - 1)x^2 + (a - 1)x + a^2 - 4a + 3 = 0$ is identity in x , then find the value of a .

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15. Show that $\frac{(x+b)(x+c)}{(b-a)(c-a)} + \frac{(x+c)(x+a)}{(c-b)(a-b)} + \frac{(x+a)(x+b)}{(a-c)(b-c)} = 1$ is an identity.

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16. A certain polynomial $P(x)x \in R$ when divided by k $x-a, x-bandx-c$ leaves remainders$a, b, andc$, resepectively. Then find remainder when $P(x)$ is divided by $(x-a)(x-b)(x-c)whereab, c$ are distinct.

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17. If α, β, γ are such that $\alpha+\beta+\gamma=2, \alpha^2+\beta^2+\gamma^2=6, \alpha^3+\beta^3+\gamma^3=8, then\alpha^4+\beta^4+\gamma^4$ is a. 18 b. 10 c. 15 d. 36

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18. If $x+y+z=12, x^2+Y^2+z^2=96$ and $\frac{1}{x}+\frac{1}{y}+\frac{1}{z}=36$. Then find the value $x^3+y^3+z^3$.

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19. In how many points graph of $y = x^3 - 3x2 + 5x - 3$ interest the x-axis?

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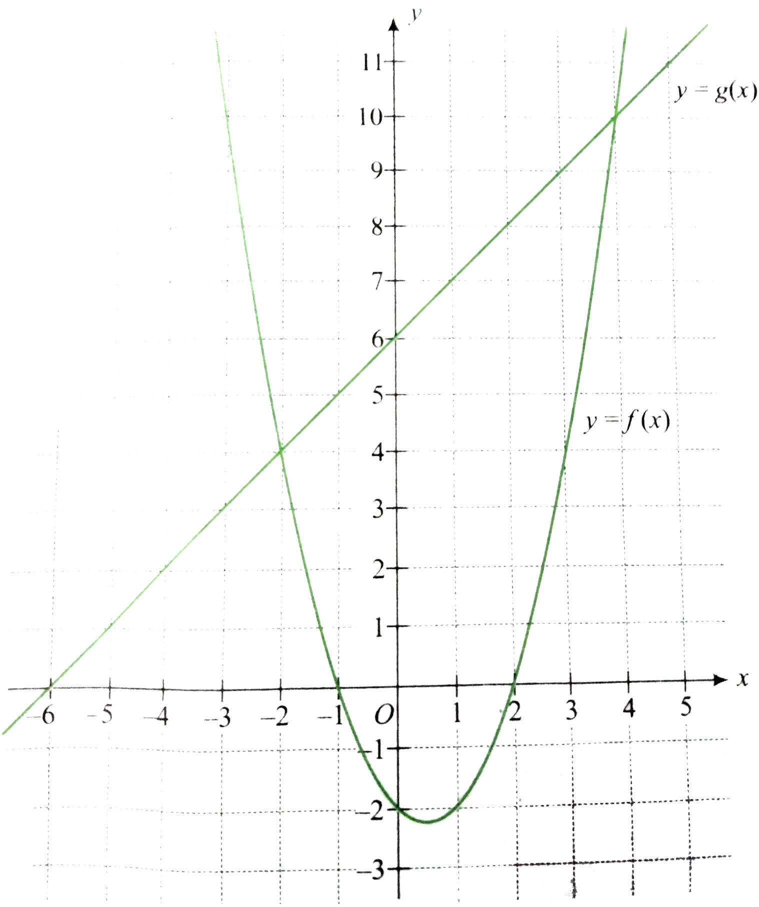
20. Consider the following figure.



Answer the following questions

(i) What are the roots of the f(x) = 0?

(ii) What are the roots of the f(x) = 4?

(iii)What are the roots of the f(x) = g (x)?

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21. Which of the following pair of graphs intersect ?

(i) y = $x^2 - x$ and y = 1

(ii) y = $x^2 - 2x + 3$ and y = sin x

(iii) = $x^2 - x + 1$ and y = x - 4

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22. Solve $\dfrac{x^2 - 2x - 3}{x + 1} = 0.$

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23. Solve $(x^3 - 4x)\sqrt{x^2 - 1} = 0.$

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24. Solve $\frac{2x-3}{x-1}+1=\frac{6x-x^2-6}{x-1}$.

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25. Evaluate $x=\sqrt{6+\sqrt{6+\sqrt{6+\infty.}}}$

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26. Sketch the graph of the following functions $y=f(x)$ and find the number of real roots of the corresponding equation $f(x)=0$.

$(i) f(x)=2x^3-9x^2+12x-(9/2)$ $(ii) f(x)=2x^3-9x^2+12x-3$

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27. Find how many roots of the equations $x^4+2x^2-8x+3=0$.

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28. How many real solutions does the equation $x^7 + 14x^5 + 16x^3 + 30x - 560 = 0$ have?

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29. If the roots of the equation $ax^2 + bx + c = 0 (a \neq 0)$ be equal then

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30. Solve $\left(x^2 - 5x + 7\right) - (x - 2)(x - 3) = 1.$

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31. Solve the equation $4^x - 5 \times 2^x + 4 = 0.$

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32. Solve the equation $12^x - 56x^2 + 89x^2 - 56x + 12 = 0.$

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33. Solve the equation $3x^{2-x} + 4x^2 = 25.$

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34. Solve the equation $(x-1)^4 + (x-5)^4 = 82.$

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35. Solve the equation $(x+2)(x+3)(x+8) \times (x+12) = 4x^2.$

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36. If the roots of the equation $x^2 - 8x + a^2 - 6a = 0$ are real distinct, then find all possible value of a.

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37. If the roots of the equation $a(b-c)x^2 + b(c-a)x + c(a-b) = 0$ are equal, show that $2/b = 1/a + 1/ \cdot$

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38. Prove that the roots of the equation $(a^4 + b^4)x^2 + 4abcdx + (c^4 + d^4) = 0$ cannot be different, if real.

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39. If roots of equation $x^3 - 2cx + ab = 0$ are real and unequal, then prove that the roots of $x^2 - 2(a+b)x + a^2 + b^2 + 2c^2 = 0$ will be

imaginary.

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40. Find the quadratic equation with rational coefficients whose one root is $1/\left(2+\sqrt{5}\right)$.

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41. If $f(x)=ax^2+bx+c,\ g(x)=-ax^2+bx+c$,where ac $\neq 0,$ then prove that $f(x)g(x)=0$ has at least two real roots.

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42. If $a, b, c\left(abc^2\right)x^2+3a^2cx+b^2cx-6a^2-ab+2b^2=0$ ares rational.

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43. If $a > 0$ and $b^2 - 4ac = 0$ then solve $ax^3 + (a+b)x^2 + (b+c)x + c > 0$.

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44. If $a, b, andc$ are odd integers, then prove that roots of $ax^2 + bx + c = 0$ cannot be rational.

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45. If $aandc$ are odd prime numbers and $ax62 + bx + c = 0$ has rational roots , where $b \in I$, prove that one root of the equation will be independent of $a, b, \cdot$

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46. Find the range of the fuction f(x) = x^(2) - 2x -4`

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47. Find the least value of $\frac{(6x^2 - 22x + 21)}{(5x^2 - 18x + 17)}$ for real x.

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48. Prove that if the equation $x^2 + 9y^2 - 4x + 3 = 0$ is satisfied for real values of $x and y, then x$ must lie between 1 and 3 and y must lie between-1/3 and 1/3.

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49. The least value of the expression $x^2 + 4y^2 + 3z^2 - 2x - 12y - 6z + 14$ is 3 b. no least value c. 0 d. none of these

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50. Find the linear factors of $2x^2 - y^2 - x + xy + 2y - 1.$

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51. If the expression $2x^2 + mxy + 3y^2 - 5y - 2$ can be resolved into two rational factors, the value of $|m|$ is

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52. Form a quadratic equation whose roots are $-4 \text{ and } 3.$

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53. Form a quadratic equation with real coefficients whose one root is $3 - 2i \cdot$

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54. If roots of the equation $ax^2 + bx + c = 0$ are α and β , find the equation whose roots are $\frac{1}{\alpha}, \frac{1}{\beta}$ (ii) $-\alpha, \; -\beta$ (iii) $\frac{1-\alpha}{1+\alpha}, \frac{1-\beta}{1+\beta}$

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55. If α, β are the roots of lthe equation $2x^2 - 3x - 6 = 0,$ find the equation whose roots are $\alpha^2 + 2 and \beta^2 + 2.$

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56. If $\alpha \neq \beta and \alpha^2 = 5\alpha - 3 and \beta^2 = 5\beta - 3.$ find the equation whose roots are $\alpha / \beta and \beta / \alpha\cdot$

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57. If roots of equation $3x^2 + 5x + 1 = 0$ are $(\sec\theta_1 - ten\theta_1)$ and $(\cos ec\theta_2 - \cot\theta_2),$ then find the equation whose roots are $(\sec\theta_1 + \tan\theta_1$ and $(\cos ec\theta_2 + \cot\theta_2).$

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58. If $ab + bc + ca = 0,$ then solve $a(b - 2c)x^2 + b(c - 2a)x + c(a - 2b) = 0.$

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59. If $a, b, andc$ are in A.P. and one root of the equation $ax^2 + bc + c = 0is2,$ the find the other root.

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60. If α is a root of the equation $x^2 + 2x - 1 = 0,$ then prove that $4\alpha^2 - 3\alpha$ is the other root.

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61. If the roots of the equadratic equation $x^2 + px + q = 0$ are $\tan 23^\circ \text{and} \tan 22^\circ$, then find the value of q - p .

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62. The sum of roots of equation $\frac{1}{x+a} + \frac{1}{x+b} = \frac{1}{c}$ is zero find the product of roots of equation a)0 b) $\left(\frac{a+b}{2}\right)$ c)$-\left(\frac{a^2+b^2}{2}\right)$ d) $2(a^2 + b^2)$

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63. Solve the equation $x^2 + px + 45 = 0$. it is given that the squared difference of its roots is equal to 144

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64. If α, β are the roots of the equation $2x^2 - 35x + 2 = 0$, the find the value of $(2\alpha - 35)^3(2\beta - 35)^3$.

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65. Find a quadratic equation whose product of roots $x_1 and x_2$ is equal to 4 and satisfying the relation $\frac{x_1}{x_1 - 1} + \frac{x_2}{x_2 - 1} = 2.$

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66. Let $\alpha, \beta \in R$. If α, β^2 are the roots of quadratic equation $x^2 - px + 1 = 0.\ and \alpha^2, \beta$ are the roots of quadratic equation $x^2 - qx + 8 = 0,$ then find $p, 1, \alpha, \beta$.

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67. If α, β are roots of $x^2 \pm px + 1 = 0 and \gamma, \delta$ are the roots of $x^2 + qx + 1 = 0$, then prove that $q^2 - p^2 = (\alpha - \gamma)(\beta - \gamma)(\alpha + \delta)(\beta + \delta)$.

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68. If the ratio of the roots of the equation $x^2 + px + q = 0$ are equal to ratio of the roots of the equation $x^2 + bx + c = 0$, then prove that $p^2 c = b^2 q$.

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69. Let n $\in$ Z and ΔABC be a right tirangle with angle at C . If sin A and sin B are the roots of the equadratic equation $(5n + 8)x^2 - (7n - 20)x + 120 = 0$, then find the value of n.

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70. Find the value of a for which one root of the quadratic equation $(a^2 - 5a + 3)x^2 + (3a - 1)x + 2 = 0$ is twice as large as the other.

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71. Find t values of the parameter a such that the rots α, β of the equation $2x^2 + 6x + a = 0$ satisfy the inequality $\alpha / \beta + \beta / \alpha < 2$.

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72. Let a, b, c be real numbers with $a \neq 0$ and α, β be the roots of the equation $ax^2 + bx + c = 0$. Express the roots of $a^3x^2 + abcx + c^3 = 0$ in terms of α, β.

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73. Let α and β be the roots of $x^2 - 5x - 1 = 0$ then find the value of $\dfrac{\alpha^{15} + \alpha^{11} + \beta^{15} + \beta^{11}}{\alpha^{13} + \beta^{13}}$.

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74. If α, β are the roots of the equation $ax^2 + bx + c = 0,$ then find the roots of the equation $ax^2 - bx(x-1) + c(x-1)^2 = 0$ in term of $\alpha and \beta$.

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75. If α and β are roots of the equation $a\cos\theta + b\sin\theta = c$, then find the value of $\tan(\alpha + \beta)$.

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76. Determine the values o m for which equations $3x^2 + 4mx + 2 = 0 and 2x^2 + 3x - 2 = 0$ may have a common root.

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77. If $ax^2 + bx + c = 0$ and $bx^2 + cx + a = 0$ have a common root and a, b, and c are nonzero real numbers, then find the value of $(a^3 + b^3 + c^3) / abc$

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78. If $x^2 + px + q = 0andx^2 + qx + p = 0, (p \neq q)$ have a common roots, show that $p + q = 0$. Also, show that their other roots are the roots of the equation $x^2 + x + pq = 0.$

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79. If equations $x^2 + ax + 12 = 0. x^2 + bx + 15 = 0andx^2 + (a + b)x + 36 = 0,$ have a common positive root, then find the values of $aandb.$

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80. If $x^2 + 3x + 5 = 0$ and $ax^2 + bx + c = 0$ have common root/roots and $a, b, c \in N$, then find the minimum value of $a + b + c$.

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81. If a, b, p, q are non zero real numbers, then how many comman roots would two equations: $2a^2x^2 - 2abx + b^2 = 0$ and $p^2x^2 + 2pqx + q^2 = 0$ have?

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82. a, b, c are positive real numbers forming a G.P. If $ax^2 + 2bx + c = 0$ and $dx^2 + 2ex + f = 0$ have a common root, then prove that $d/a, e/b, f/c$ are in A.P.

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83. Find the condition on a, b, c, d such that equations $2ax^3 + bx^2 + cx + d = 0$ and $2ax^2 + 3bx + 4c = 0$ have a common root.

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84. Number of positive integers x for which $f(x) = x^3 - 8x^2 + 20x - 13$ is a prime number is_____.

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85. If r is positive real number such that $4\sqrt{r} - \frac{1}{4\sqrt{r}} = 4,$ then find the value of $6\sqrt{r} + \frac{1}{6\sqrt{r}}$.

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86. If α, β and γ the roots of the equation $x^3 + 3x^2 - 4x - 2 = 0.$

then find the values of the following expressions:

(i) $\alpha^2 + \beta^2 + \gamma^2$

(ii)$\alpha^3 + \beta^3 + \gamma^3$

(iii) $\frac{1}{\alpha} + \frac{1}{\beta} + \frac{1}{\gamma}$

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87. If α, β, γ are the roots of the equation $x^3 + 4x + 1 = 0$ then $(\alpha + \beta)^{-1} + (\beta + \gamma)^{-1} + (\gamma + \alpha)^{-1} =$

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88. Equations $x^3 + 5x62 + px + q = 0andx63 + 7x^2 + px + r = 0$ have two roots in common. If the third root of each equation is x_1andx_2, respectively, then find the ordered pair *[Math Processing Error]*

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89. If α, β and γ are the roots of the equation $x^3 + 3x^2 - 24x + 1 = 0$ then find the value of $\left(3\sqrt{\alpha} + 3\sqrt{\beta} + 3\sqrt{\gamma}\right)$.

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90. If euation $x^3 + ax^2 + bx + c = 0,$ where a, b, c $\in Q(a \neq$ 1). If the real roots of the equation are x_1, x_2 and $x_1x_2,$ then prove that x_1x_2 is rational.

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91. Solve the equation $x^3 - 13x^2 + 15x + 189 = 0$ if one root exceeds the other by 2.

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92. In equation $x^4 - 2x^3 + 4x^2 + 6x - 21 = 0$ if two its roots are equal in magnitude but opposite e in find the roots.

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93. If $b^2 < 2ac$, then prove that $ax^2 + bx^2 + cx + d = 0$ has exactly one real root.

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94. If $f(x) = x^2 + bx^2 + cx + dandf(0), f(-1)$ are odd integers, prove that $f(x) = 0$ cannot have all integral roots.

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95. If $x - c$ is a factor of order m of the polynomial $f(x)$ of degree n (1 < m < n) , then find the polynomials for which $x = c$ is a root.

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96. What is the minimum height of any point on the curve $y = x^2 - 4x + 6$ above the x-axis?

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97. What is the maximum height of any point on the curve $y = -x^2 + 6x - 5$ above the x-axis?

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98. Find the largest natural number a for which the maximum value of $f(x) = a - 1 + 2x - x^2$ is smaller thante ninimum value of $g(x) = x^2 - 2ax = 10 - 2a$.

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99. Let $f(x) = ax^2 + bx + c$ be a quadratic expression having its vertex at (3, -2) and value of $f(0) = 10$. Find $f(x)$.

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100. Find the least value of n such that $(n-2)x^2 + x + n + 4 > 0, \forall x \in R, wheren \in N$.

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101. Given that a, b, c are distinct real numbers such that expressions $ax^2 + bx + c, bx^2 + cx + aandcx^2 + ax + b$ are always non-negative. Prove that the quantity $\left(a^2 + b^2 + c^2\right) / (ab + bc + ca)$ can never lie inn $(-\infty, 1)$.

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102. For a $\in$ R, if $|x-a+3|+|x-3a|=|2x-4a+3|$ is ture $\forall x \in$ R. Then find the value of a.

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103. If c is positive and $2ax^2+3bx+5c=0$ does not have any real roots, then prove that $2a-3b+5b>0$.

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104. If $ax^2+bx+6=0$ does not have distinct real roots, then find the least value of $3a+b$.

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105. A quadratic trinomial $P(x)=ax^2+bx+c$ is such that the equation $P(x)=x$ has o real roots. Prove that in this case equation

$P(P(x)) = x$ has no real roots either.

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106. If the inequality $\left(mx^2 + 3x + 4 + 2x\right) / \left(x^2 + 2x + 2\right) < 5$ is satisfied for all $x \in R$, then find the value of m.

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107. Find the values of k for which $\left|\frac{x^2 + kx + 1}{x^2 + x + 1}\right| < 2, \forall x \in R$

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108. If $x \in R, and a, b, c$ are in ascending or descending order of magnitude, show that $(x - a)(x - c) / (x - b)(where x \neq b)$ can assume any real value.

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109. Let $x^2 - (m-3)x + m = 0(m \in$ R) be a quadratic equation. Find the value of m for which the roots are

(i) real and distinct

(ii) equal

(iii) not real

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110. If α is a real root of the quadratic equation $ax^2 + bx + c = 0 and \beta$ ils a real root of $-ax^2 + bx + c = 0,$ then show that there is a root γ of equation $(a/2)x^2 + bx + c = 0$ whilch lies between $a and \beta.$

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111. The equation $ax^2 - bx + c = 0$ has real and positive roots. Prove that the roots of the equation $ad^2x^2 + a(3b-2c)x + (2b-c)(b-c) + ac = 0$ re real and positive.

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112. For what real values of a do the roots of the equation $x^2 - 2x - \left(a^2 - 1\right) = 0$ lie between the roots of the equation $x^2 - 2(a+1)x + a(a-1) = 0.$

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113. If $\left(x^2 + x = 2\right)62 = (a-3)\left(x^2 + x + 1\right)\left(x^2 + x + 2\right) + (a-4)\left(x^2 + x +\right.$

has at least one root, then find the complete set of values of a.

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114. Find all real value of a for which the equation $x^4 + (a-1)x^3 + x^2 + (a-1)x + 1 = 0$ possesses at least two distinct positive roots

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115. If the equation $\sin^2 x - k \sin x - 3 = 0$ has exactly two distinct real roots in $[0, \pi]$, then find the values of k .

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116. Find all the value of m for which the equation $\sin^2 x + (m-3)\sin x + m = 0$ has real roots.

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117. If $2a + 3b + 6c = 0,$ then prove that at least one root of the equation $ax^2 + bx + c = 0$ lies in the interval (0,1).

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118. Find the value of a for which $ax^2 + (a-3)x + 1 < 0$ for at least one positive real x.

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119. If $x^2 + 2ax + a < 0 \forall x \in [1, 2]$, the find the values of a.

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120. If $\left(y^2 - 5y + 3\right)\left(x62 + x + 1\right) < 2x$ for all $x \in R$, then fin the interval in which y m lies.

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121. The values of 'a' for which $4^x - (a-4)2^x + \frac{9a}{4} < 0 \forall x \in (1, 2)$ is

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SOLVED EXAMPLES

1. IF $\left[x^2 - 2x + a\right] = 0$ has no solution, then find the values of a (where $[\cdot]$ represents the greatest integer).

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2. If $a_1x^3 + b_1x^2 + c_1x + d_1 = 0$ and $a_2x^3 + b_2x^2 + c_2x + d_2 = 0$ a pair of repeated roots common, then prove that

$$\begin{vmatrix} 3a_1, & 2b_1, & c_1 \\ 3a_2, & 2b_2, & c_2 \\ a_2b_1 - a_1b_2, & c_2a_1 - c_2a_1, & d_1a_2 - d_2a_1 \end{vmatrix} = 0$$

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3. Let S be a square of unit area. Consider any quadrilateral which has one vertex on each side of S. If a, b, c and d denote the lengths of sides of the quadrilateral, prove that $2 \leq a_2 + b_2 + c_2 + d_2 \leq 4$

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4. Show that the minimum value of $(x+a)(x+b)/(x+c)\dot{w}herea > c, b > c,$ is $\left(\sqrt{a-c}+\sqrt{b-c}\right)^2$ for real values of $x \succ \cdot$

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5. Let $f(x), g(x), andh(x)$ be the quadratic polynomials having positive leading coefficients and real and distinct roots. I eco pair of them has a common roots, then fine the roots of $f(x)+g(x)+h(x)=0.$

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6. If the slope of one of the pairs of lines represented by equation $a^3x^2+2hxy+b^3y^2=0$ is square of the other, then prove that $ab(a+b)=-2h.$

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7. If $f(x)=(a_1x+b_1)^2+(a_2x+b_2)^2+\ldots+(a_nx+b_n)^2$, then prove that

$(a_1b_1+a_2b_2+\ldots+a_nb_n)^2\leq(a_1^2+a_2^2+\ldots+a_n^2)(b_1^2+b_2^2+..+b_n^2)\cdot$

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8. Find the values of a for which the expression $\dfrac{ax^2+3x-4}{3x-4x^2+a}$ assumes all real values for all real values of x

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9. Let $a, bandc$ be real numbers such that $a+2b+c=4$. Find the maximum value of $(ab+bc+ca)\cdot$

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10. If $x^4 + 2kx^3 + x^2 + 2kx + 1 = 0$

has exactly tow distinct positive and two distinct negative roots, then find the possible real values of k.

View Text Solution

11. Find the value of a for which the equation a $\sin\left(x + \frac{\pi}{4}\right) = \sin 2x + 9$ will have real solution.

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12. Prove that if $2a_0^2 < 15a$, all roots of $x^5 - a_0x^4 + 3ax^3 + bx^2 + cx + d = 0$ cannot be real. It is given that $a_0, a, b, c, d \in R$.

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13. Find the values $'a'$ for which the function $f(x) = (a+2)x^3 - 3ax^2 + 9ax - 1$ decreases for all real values of x .

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14. Find the number of points of local extrema of $f(x) = 3x^4 - 4x^3 + 6x^2 + ax + b$ where $a, b \in R$

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CONCEPT APPLICATION EXERCISE 2.1

1. If $x = 1 and x = 2$ are solutions of equations $x^3 + ax^2 + bx + c = 0 and a + b = 1,$ then find the value of b.

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2. If $(1-p)$ is a root of quadratic equation $x^2 + px + (1-p) = 0$, then find its roots.

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3. The quadratic polynomial $p(x)$ ha following properties $p(x)$ can be positive or zero for all real numbers $p(1) = 0andp(2) = 2$. Then find the quadratic polynomial.

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CONCEPT APPLICATION EXERCISE 2.2

1. Given that the expression $2x^3 + 3px^2 - 4x + p$ has a remainder of 5 when divided by $x + 2$, find the value of p.

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2. Determine the value of k for which $x+2$ is a factor of $(x+1)^7+(2x+k)^3$.

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3. If $f(x)=x^3-3x^2+2x+a$ is divisible by $x-1$, then find the remainder when $f(x)$ is divided by $x-2$.

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4. If $f(x)=x^3=x^2+ax+b$ is divisible by x^2-x, then find the value of $f(2)$.

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5. Let the equation $x^5+x^3+x^2+2=0$ has roots x_1, x_2, x_3, x_4 and x_5, then find the value of $(x_1^2-1)(x_2^2-1)(x_3^2-1)(x_4^2-1)(x_5^2-1)$.

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CONCEPT APPLICATION EXERCISE 2.3

1. The number of values of a for which $\left(a^2-3a+2\right)x^2+\left(a^2-5a+6\right)x+a^2-4=0$ is an identity in x is

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2. If x^2+ax+1 is a factor of ax^3+bx+c, then which of the following conditions are not valid: a. $a^2+c=0$ b. $b-a=ac$ c. $c^3+c+b^2=0$ d. $2c+a=b$

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3. If $a+b+c=0$ and $a^2+b^2+c^2=4$, them find the value of $a^4+b^4+c^4$.

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CONCEPT APPLICATION EXERCISE 2.4

1. Prove that graphs of $y = x^2 + 2 and y = 3x - 4$ never intersect.

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2. In how many points the line $y + 14 = 0$ cuts the curve whose equation is $x\left(x^2 + x + 1\right) + y = 0$?

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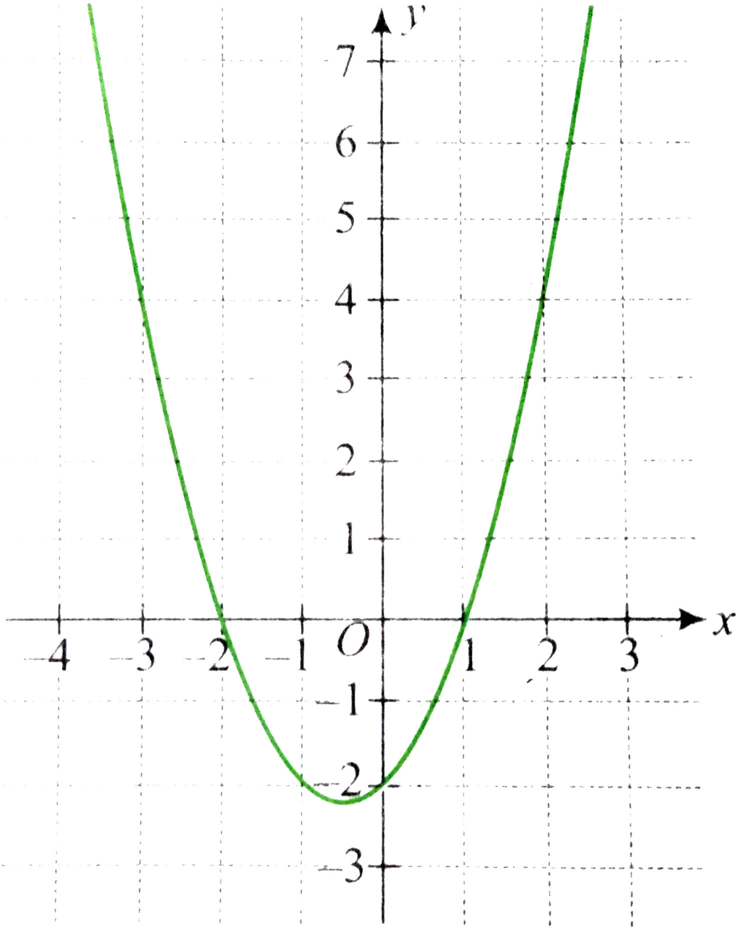
3. Graph of $y = f(x)$ is as shown in the following figure.



Find the roots of the following equations

$f(x) = 0$

$f(x) = 4$

$f(x) = x + 2$

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CONCEPT APPLICATION EXERCISE 2.5

1. Solve $\dfrac{x^2+3x+2}{x^2-6x-7}=0.$

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2. Solve $\sqrt{x-2}+\sqrt{4-x}=2.$

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3. Solve $\sqrt{x-2}\left(x^2-4x-5\right)=0.$

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4. Solve $\sqrt{x+5}\sqrt{x+21}=\sqrt{6x+40.}$

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CONCEPT APPLICATION EXERCISE 2.6

1. How many roots of the equation $3x^4 + 6x^3 + x^2 + 6x + 3 = 0$ are real ?

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2. Find the value of a if $x^3 - 3x + a = 0$ has three distinct real roots.

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3. Analyze the roots of the equation $(x-1)^3 + (x-2)^3 + (x-4)^3 + (x-5)^3 = 0$ by differentiation method.

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4. In how many points the graph of $f(x) = x^3 + 2x^2 + 3x + 4$ meets the $xa\xi s$?

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CONCEPT APPLICATION EXERCISE 2.7

1. Solve the equation $x(x+2)\left(x^2-1\right) = -1.$

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2. Solve $\left(x^2+2\right)^2 + 8x^2 = 6x\left(x^2+2\right)$

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3. Find the value of $2 + \dfrac{1}{2 + \dfrac{1}{2 + \frac{1}{2 + \infty}}}$

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4. Solve $4^x + 6^x = 9^x$.

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5. Solve 3^(2x^(2)-7x + 7) = 9

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6. Solve $\dfrac{8^x + 27^x}{12^x + 18^x} = \dfrac{7}{6}$

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7. Solve $\sqrt{3x^2 - 7x - 30} + \sqrt{2x^2 - 7x - 5} = x + 5$.

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8. Solve $\sqrt{5x^2-6x+8}+\sqrt{5x^2-6x-7}=1.$

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9. Solve $\sqrt{x^2+4x-21}+\sqrt{x^2-x-6}=\sqrt{6x^2-5x-39.}$

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CONCEPT APPLICATION EXERCISE 2.8

1. If $a, b, c \in R^+ and 2b = a+c,$ then check the nature of roots of equation $ax^2+2bx+c=0.$

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2. Find the condition if the roots of $ax^2+2bx+c=0$ and $bx^2-2\sqrt{acx}+b=0$ are simultaneously real.

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3. if a $< c < b,$ then check the nature of roots of the equation

$(a-b)^2x^2 + 2(a+b-2c)x + 1 = 0$

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4. If $a+b+c=0$ then check the nature of roots of the equation

$4ax^2 + 3bx + 2c = 0 where a, b, c \in R.$

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5. Find the greatest value of a non-negative real number λ for which both the equations $2x^2 + (\lambda - 1)x + 8 = 0 and x^2 - 8x + \lambda + 4 = 0$ have real roots.

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6. If $a, b, c \in R$ such that $a+b+c=0 and a \neq c$, then prove that the roots of $(b+c-a)x^2+(c+a-b)x+(a+b-c)=0$ are real and distinct.

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7. If $p, q \in \{1, 2, 3, 4, 5\}$, then find the number of equations of form $p^2x^2+q^2x+1=0$ having real roots.

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8. Find the range of $f(x)=x^2-x-3$.

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9. Find the rang of $f(x)=\dfrac{x^2+34x-71}{x^2+2x-7}$ $f(x)=\dfrac{x^2-x+1}{x^2+x+1}$

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10. Find the range of $f(x)\sqrt{x-1}+\sqrt{5-1}$

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11. If $x, y \in R$ satisfy the equation $x^2+y^2-4x-2y+5=0$, then the value of the expression $\dfrac{\left(\sqrt{x}-\sqrt{y}\right)^2+4\sqrt{xy}}{\left(x+\sqrt{xy}\right)}$ is

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CONCEPT APPLICATION EXERCISE 2.9

1. If the product of the roots of the equation $(a+1)x^2+(2a+3)x+(3a+4)=0is2,$ then find the sum roots.

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

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3. If $x_1, and x_2$ are the roots of $x^2+(\sin\theta-1)x-\frac{1}{2\cos^2\theta}=0,$ then find the maximum value of $x12+x22.$

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4. If $\tan\theta and \sec\theta$ are the roots of $ax^2+bx+c=0,$ then prove that $a^4=b^2(b^2-4ac).$

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5. If the roots of $x^2-bx+c=0$ are two consecutive integers then $b^2-4c=$

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6. If he roots of the equation$12x^2 - mx + 5 = 0$ are in the ratio 2:3 then find the value of $m.$

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7. If α and β are the roots of $x^2 - p(x+1) - c = 0$, then the value of $\frac{\alpha^2 + 2\alpha + 1}{\alpha^2 + 2\alpha + c} + \frac{\beta^2 + 2\beta + 1}{\beta^2 + 2\beta + c}$

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8. If the equation formed by decreasing each root of the $ax^2 + bx + c = 0$ by 1 $2x^2 + 8x + 2 = 0$. Find the condition.

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9. If $\alpha and \beta$ are the roots of $x^2 - a(x-1) + b = 0$ then find the value of $1/\left(\alpha^2 - a\alpha\right) + 1/\left(\beta^2 - \beta\right) + 2/a + b$.

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10. Find the range of $f(x) = \sqrt{x-1} + \sqrt{5-x}$

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11. Let α, β be the roots of $x^2 + bx + 1 = 0$. Them find the equation whose roots are $-(\alpha + 1/\beta)$ and $-(\beta + 1/\alpha)$.

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12. If the sum of the roots of an equation is 2 and the sum of their cubes is 98, then find the equation.

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CONCEPT APPLICATION EXERCISE 2.10

1. If $x^2 + ax + b = 0 and x^2 + bx + ca = 0 (a \neq b)$ have a common root, then prove that their other roots satisfy the equation $x^2 + cx + ab = 0.$

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2. Find the condition that the expressions $ax^2 - bxy + cy^2 and a_1x^2 + b_1xy + c_1y^2$ may have factors $y - mx and my - x,$ respectively.

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3. If $a, b, c \in R$ and equations $ax^2 + bx + c = 0 and x^2 + 2x + 9 = 0$ have a common a rot, then find $a : b :\ \cdot$

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4. If the equations $x^3 - mx^2 - 4 = 0$ and $x^3 + mx + 2 = 0. m \in R$ have one common root, then find the values of m.

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5. If a, b, c be the sides of ABC and equations $ax62 + bx + c = 0and5x^2 + 12 + 13 = 0$ have a common root, then find $\angle C$.

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CONCEPT APPLICATION EXERCISE 2.11

1. Let a is a real number satisfying $a^3 + \frac{1}{a^3} = 18$. Then the value of $a^4 + \frac{1}{a^4} - 39$ is ____.

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2. If two roots of $x^3 - ax^2 + bx - c = 0$ are equal in magnitude but opposite in signs, then prove that $ab = c$

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3. If $\alpha, \beta and \gamma$ are the roots of $x^2 + 8 = 0$ then find the equation whose roots are $\alpha^2, \beta^2 and \gamma^2$.

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4. If α, β, γ are the roots of the equation $x^3 - px + q = 0$, ten find the cubic equation whose roots are $\alpha/(1+\alpha), \beta/(1+\beta), \gamma/(1+\gamma)$.

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5. If the roots of equation $x^3 + ax^2 + b = 0 are \alpha_1, \alpha_2$, and $\alpha_3 (a, b \neq 0)$. Then find the equation whose roots are

$$\frac{\alpha_1\alpha_2 + \alpha_2\alpha_3}{\alpha_1\alpha_2\alpha_3}, \frac{\alpha_2\alpha_3 + \alpha_3\alpha_1}{\alpha_1\alpha_2\alpha_3}, \frac{\alpha_1\alpha_3 + \alpha_1\alpha_2}{\alpha_1\alpha_2\alpha_3}.$$

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6. If $\alpha, \beta and \gamma$ are roots of $2x63 + x^3 - 7 = 0$, then find the value of $\sum\left(\frac{\alpha}{\beta} + \frac{\beta}{\alpha}\right)$.

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7. Let $r, s, and t$ be the roots of equation $8x^2 + 1001x + 2008 = 0.$ Then find the value of .

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8. The polynomial $f(x) = x^4 + ax^3 + bx^3 + cx + d$ has real coefficients and $f(2i) = f(2 + i) = 0.$ Find the value of $(a + b + c + d)$.

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CONCEPT APPLICATION EXERCISE 2.12

1. If $f(x) = \sqrt{x^2 + ax + 4}$ is defined for all x, then find the values of a.

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2. If $ax^2 + bx + c = 0, a, b, c \in$ R has no real roots, and if $c <$ 0, the which of the following is ture ? (a) a $<$ 0 (b) a + b + c $>$ 0 (c) $a + b + c <$ 0

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3. If $ax^2 + bx + c = 0$ has imaginary roots and `a+b+c

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4. Let $x, y, z \in R$ **such that** $x_y + z = 6an \times y + yz + zx = 7.$ **Then find the range of values of** $x, y, andz.$

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5. If x is real and $(x^2 + 2x + c) / (x^2 + 4x + 3c)$ can take all real values, of then show that $0 \leq c \leq 1$.

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6. Prove that for all real values of x and y, $x^2 + 2xy + 3y^2 - 6x - 2y \geq -11$.

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7. Find the complete set of values of a such that $(x^2 - x) / (1 - ax)$ attains all real values.

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8. If the quadratic equation $ax^2 + bx + 6 = 0$ does not have real roots and $b \in R^+$, then prove that $a > max\left\{\frac{b^2}{24}, b - 6\right\}$

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9. If x is real and the roots of the equation $ax^2 + bx + c = 0$ are imaginary, then prove tat $a^2x^2 + abx + ac$ is always positive.

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10. Let a, b, c be real. If $ax^2 + bx + c = 0$ has two real roots $\alpha and \beta, where \alpha \langle -1 and \beta \rangle 1$, then show that $1 + \frac{c}{a} + \left|\frac{b}{a}\right| < 0$

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11. If $x^2 + (a - b)x + (1 - a - b) = 0. where a, b \in R,$ then find the values of a for which equation has unequal real roots for all values of b.

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CONCEPT APPLICATION EXERCISE 2.13

1. Find the values of a if $x^2 - 2(a-1)x + (2a+1) = 0$ has positive roots.

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2. If the equation $(a-5)x^2 + 2(a-10)x + a + 10 = 0$ has roots of opposite sign , then find the values of a .

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3. If both the roots of $x^2 - ax + a = 0$ are greater than 2, then find the value of $a \cdot$

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4. If both the roots of $ax^2 + ax + 1 = 0$ are less than 1, then find the exhaustive range of values of $a \cdot$

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5. If both the roots of $x^2 + ax + 2 = 0$ lies in the interval (0, 3), then find the exhaustive range of value of $a \cdot$

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6. If α, β are the roots of $x^2 - 3x + a = 0, a \in R \text{ and } < 1 < \beta,$ then find the values of a

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7. If α is the root (having the least absolute value) of the equation $x^2 - bx - 1 = 0(b \in R^+)$, then prove that $-1 < \alpha < 0.$

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8. If $a < b < c < d$, then for any real non-zero λ, the quadratic equation $(x-a)(x-c)+\lambda(x-b)(x-d)=0$,has real roots for

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9. Find the values of a for whilch the equation $\sin^4 x + a\sin^2 x + 1 = 0$ will have ea solution.

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Single Correct Answer Type : Exercise

1. The value of expression $x^4 - 8x^3 + 18x^2 - 8x + 2$ when $x = 2 + \sqrt{3}$

A. 2

B. 1

C. 0

D. 3

Answer: B

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2. $x = 1 + \cfrac{1}{3 + \cfrac{1}{2 + \cfrac{1}{3 + \cfrac{1}{2 \ldots \infty}}}}$ then the value of x

A. $\sqrt{\frac{5}{2}}$

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

C. $\sqrt{\frac{7}{3}}$

D. $\sqrt{\frac{5}{3}}$

Answer: 4

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3. The sum of the non-real root of $(x^2+x-2)(x^2+x-3)=12$ is -1

b. 1 c. -6 d. 6

A. -1

B. 1

C. -6

D. 6

Answer: 1

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4. The number of irrational roots of the equation $\frac{4x}{x^2+x+3}+\frac{5x}{x^2-5x+3}=-\frac{3}{2}$ is

A. 4

B. 0

C. 1

D. 2

Answer: 4

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5. The curve $y=(\lambda+1)x^2+2$ intersects the curve $y=\lambda x+3$ in exactly one point, if λ equals $\{-2, 2\}$ b. $\{1\}$ c. $\{-2\}$ d. $\{2\}$

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

B. $\{1\}$

C. $\{-2\}$

D. $\{2\}$

Answer: 3

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6. If the expression $x^2 + 2(a+b+c)x + 3(bc+ca+ab)$ is a perfect square then

A. a = b = c

B. $a = \pm b = \pm c$

C. $a = b \neq c$

D. none of these

Answer: 1

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7. If $(ax^2 + c)y + (ax^2 + c) = 0$ and x is a rational function of y and ac is negative, then

A. $ac' + a'c = 0$

B. $a/a' = c/c'$

C. $a^2 + c^2 = a'^2 + c'^2$

D. $aa' + cc' = 0$

Answer: 2

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8. If a, b, c are three distinct positive real numbers, the number of real and distinct roots of $ax^2 + 2b|x| - c = 0$ is 0 b. 4 c. 2 d. none of these

A. 0

B. 4

C. 2

D. none of these

Answer: 3

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9. Let a, b and c be real numbers such that $4a + 2b + c = 0$ and $ab > 0.$

Then the equation ax^(2) + bx + c = 0` has

A. complex roots

B. exactly one root

C. real roots

D. none of these

Answer: 3

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10. If $a \in (-1, 1),$ then roots of the quadratic equation $(a-1)x^2 + ax + \sqrt{1-a^2} = 0$ are a. real b. imaginary c. both equal d. none of these

A. real

B. imaginary

C. both equal

D. none of these

Answer: 1

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11. The integral value of for which the root of the equation $mx^2 + (2m-1)x + (m-2) = 0$ are rational are given by the expression [where n is integer] n^2 b. $n(n+2)$ c. $n(n+1)$ d. none of these

A. n^2

B. $n(n+2)$

C. $n(n+1)$

D. none of these

Answer: 3

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12. $x^2 - xy + y^2 - 4x - 4y + 16 = 0$ represents a. a point b. a circle c. a pair of straight line d. none of these

A. a point

B. a circle

C. a pair of straight lines

D. none of these

Answer: 1

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13. If the roots of the equation $x^2 + 2ax + b = 0$ are real and distinct and they differ by at most $2m, thenb$ lies in the interval $(a^2, a^2, +m^2)$ b. $(a^2 - m^2, a62)$ c. $[a^2 - m^2, a^2)$ d. none of these

A. $(a^2, a^2 + m^2)$

B. $\left(a^2 - m^2, a^2\right)$

C. $\left[a^2 - m^2, a^2\right)$

D. none of these

Answer: 3

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14. If x is real, then $x / \left(x^2 - 5x + 9\right)$ lies between $-1 and -1/11$ b. $1 and -1/11$ c. $1 and 1/11$ d. none of these

A. $-1 \text{ and } -1/11$

B. $1 \text{ and } -1/11$

C. $1 \text{ and } 1/11$

D. none of these

Answer: 2

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15. If $x^2 + ax - 3x - (a+2) = 0$ has real and distinct roots, then the minimum value of $(a^2+1)/(a^2+2)$ is 1 b. 0 c. $\frac{1}{2}$ d. $\frac{1}{4}$

A. 1

B. 0

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

D. $\frac{1}{4}$

Answer: C

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16. If $a, b, c, d \in R$, then the equation $(x^2 + ax - 3b)(x^2 - cx + b)(x^2 - dx + 2b) = 0$ has a. 6 real roots b. at least 2 real roots c. 4 real roots d. none of these

A. 6 real roots

B. at least 2 real roots

C. 4 real roots

D. 3 real roots

Answer: 2

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17. (B) (2, 9/4) If two roots of the equation $(a-1)\left(x^2+x+1\right)^2-(a+1)\left(x^4+x^2+1\right)=0$ are real and distinct, then a lies in the interval

A. $(-\infty, 3]$

B. $(-\infty, -2) \cup (2, \infty)$

C. $[-2, 2]$

D. $[-3, \infty)$

Answer: 2

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18. If $b_1b_2 = 2(c_1 + c_2)$, then at least one of the equations $x^2 + b_1x + c_1 = 0$ and $x^2 + b_2x + c_2 = 0$ has

A. imaginary roots

B. real roots

C. purely imaginary roots

D. none of these

Answer: 2

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19. Suppose A, B, C are defined as $A = a^2b + ab^2 - a^2c - ac^2$, $B = b^2c + bc^2 - a^2b - ab^2$, and $C = a^2c + ac^2 - b^2c - bc^2$, where $a > b > c > 0$ and the equation $Ax^2 + Bx + C = 0$ has equal roots, then a, b, c are in

A. A.P.

B. G.P.

C. H.P.

D. A.G.P.

Answer: 3

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20. If α, β are the roots of $x^2 - px + q = 0$ and α', β' are the roots of $x^2 - p'x + q' = 0$, then the value of $(\alpha - \alpha')^2 + (\beta + \alpha')^2 + (\alpha - \beta')^2 + (\beta - \beta')^2$ is

A. $2\{p^2 - 2q + p'^2 - 2q' - pp'\}$

B. $2\{p^2 - 2q + p'^2 - 2q' - qq'\}$

C. $2\{p^2 - 2q - p'^2 - 2q' + pp'\}$

D. $2\{p^2 - 2q - p'^2 - 2q' - qq'\}$

Answer: 1

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21. If α, β are the roots of the equation $ax^2 + bx + c = 0,$ then the value of $\frac{a\alpha^2 + c}{a\alpha + b} + \frac{a\beta^2 + c}{a\beta + b}$ is a. $\frac{b(b^2 - 2ac)}{4a}$ b. $\frac{b^2 - 4ac}{2a}$ c. $\frac{b(b^2 - 2ac)}{a^2c}$ d. none of these

A. $\frac{b(b^2 - 2ac)}{4a}$

B. $\frac{b^2 - 4ac}{2a}$

C. $\frac{b(b^2 - 2ac)}{a^2c}$

D. none of these

Answer: C

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22. The quadratic $x^2 + ax = b + 1 = 0$ has roots which are positive integers, then $(a^2 + b^2)$ can be equal to 50 **b.** 37 **c.** 61 **d.** 19

A. 50

B. 37

C. 61

D. 19

Answer: 1

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23. If α, β re the roots of $ax^2 + c = bx,$ then the equation $(a + cy)^2 = b^2 y$ in y has the roots $\alpha\beta^{-1}, \alpha^{-1}\beta$ **b.** α^{-2}, β^{-2} **c.** α^{-1}, β^{-1} **d.** α^2, β^2

A. $\alpha\beta^{-1}, \alpha^{-1}\beta$

B. α^{-2}, β_{-2}

C. α^{-1}, β^{-1}

D. α^2, β^2

Answer: 2

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24. If $\alpha and \beta$ are roots of the equation $ax^2 + bx + c = 0,$ then the roots of the equation $a(2x+1)^2 - b(2x+1)(3-x) + c(3-x)^2 = 0$ are $\frac{2\alpha+1}{\alpha-3}, \frac{2\beta+1}{\beta-3}$ b. $\frac{3\alpha+1}{\alpha-2}, \frac{3\beta+1}{\beta-2}$ c. $\frac{2\alpha-1}{\alpha-2}, \frac{2\beta+1}{\beta-2}$ d. none of these

A. $\frac{2\alpha+1}{\alpha-3}, \frac{2\beta+1}{\beta-3}$

B. $\frac{3\alpha+1}{\alpha-2}, \frac{2\beta+1}{\beta-2}$

C. $\frac{2\alpha-1}{\alpha-2}, \frac{2\beta+1}{\beta-2}$

D. none of these

Answer: 2

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25. If the roots of the equation $ax^2 - bx + c = 0$ are $\alpha, \beta,$ then the roots of the equation $b^2cx^2 - ab^{2x} + a^3 = 0$ are

A. $\dfrac{1}{\alpha^3 + \alpha\beta}, \dfrac{1}{\beta^3 + \alpha\beta}$

B. $\dfrac{1}{\alpha^2 + \alpha\beta}, \dfrac{1}{\beta^2 + \alpha\beta}$

C. $\dfrac{1}{\alpha^4 + \alpha\beta}, \dfrac{1}{\beta^4 + \alpha\beta}$

D. none of these

Answer: 2

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26. If $a(p+q)^2 + 2bpq + c = 0$ and $a(p+r)^2 + 2bpr + c = 0 (a \neq 0)$, then which one is correct? a) $qr = p^2$ b) $qr = p^2 + \dfrac{c}{a}$ c) none of these d) either a) or b)

A. $qr = p^2$

B. $qr = p^2 + \frac{c}{a}$

C. $qr = -p^2$

D. none of these

Answer: 2

Watch Video Solution

27. If α, β are the nonzero roots of $ax^2 + bx + c = 0 and \alpha^2, \beta^2$ are the roots of $a^2x^2 + b^2x^2 + b^2x + c^2 = 0, then a, b, c$ are in a. G.P. b. H.P. c. A.P. d. none of these

A. G.P.

B. H.P.

C. A.P.

D. none of these

Answer: 1

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28. If the roots of the equation $ax^2 + bx + c = 0$ are of the form $(k+1)/kand(k+2)/(k+1), then(a+b+c)^2$ is equal to $2b^2 - ac$ b. $a62$ c. $b^2 - 4ac$ d. $b^2 - 2ac$

A. $2b^2 - ac$

B. a^2

C. $b^2 - 4ac$

D. $b^2 - 2ac$

Answer: 3

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29. If α, β are the roots of $ax^2 + bx + c = 0$ and $\alpha + h, \beta + h$ are the roots of $px^2 + qx + r = 0$, then h =

A. $-\frac{1}{2}\left(\frac{a}{b}-\frac{p}{q}\right)$

B. $\left(\frac{b}{a}-\frac{q}{p}\right)$

C. $\frac{1}{2}\left(\frac{b}{a}-\frac{q}{p}\right)$

D. none of these

Answer: C

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30. If one root of $x^2-x-k=0$ is square of the other, then find the value of k.

A. $2\pm\sqrt{5}$

B. $2\pm\sqrt{3}$

C. $3\pm\sqrt{2}$

D. $5\pm\sqrt{2}$

Answer: 1

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31. If α and β be the roots of the equation $x^2 + px - 1/(2p^2) = 0$, where $p \in R$. Then the minimum value of $\alpha^4 + \beta^4$ is

A. $2\sqrt{2}$

B. $2 - \sqrt{2}$

C. 2

D. $2 + \sqrt{2}$

Answer: 4

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32. If α, β are the roots of $x^2 + px + q = 0$ and γ, δ are the roots of $x^2 + px + r = 0$, then $\dfrac{(\alpha - \gamma)(\alpha - \delta)}{(\beta - \gamma)(\beta - \delta)} =$

(a) 1 (b) q (c) r (d) $q + r$

A. 1

B. q

C. r

D. q + r

Answer: 1

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33. The value of m for which one of the roots of $x^2 - 3x + 2m = 0$ is double of one of the roots of $x^2 - x + m = 0$ is

A. -2

B. 1

C. 2

D. none of these

Answer: A

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34. If the equation $x^2 - 3px + 2q = 0 and x^2 - 3ax + 2b = 0$ have a common roots and the other roots of the second equation is the reciprocal of the other roots of the first, then $(2 - 2b)^2$. $36pa(q - b)^2$ b. $18pa(q - b)^2$ c. $36bq(p - a)^2$ d. $18bq(p - a)^2$

A. $36pa(q - b)^2$

B. $18pa(q - b)^2$

C. $36bq(p - a)^2$

D. $18bq(p - a)^2$

Answer: 3

Watch Video Solution

35. If α, β are the roots of the equation $x^2 - 2x + 3 = 0$ obtain the equation whose roots are $\alpha^3 - 3\alpha^2 + 5\alpha - 2$ and $\beta^3 - \beta^2 + \beta + 5$

A. $x^2 = 3x + 2 = 0$

B. $x^2 - 3x - 2 = 0$

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

D. none of these

Answer: 3

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36. A quadratic equation with integral coefficients has two different prime numbers as its roots. If the sum of the coefficients of the equation is prime, then the sum of the roots is a. 2 b. 5 c. 7 d. 11

A. 2

B. 5

C. 7

D. 11

Answer: 2

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37. One of the roots of $ax^2 + bx + c = 0$ is greater than 2 and the other is less than -1. If the roots of $cx^2 + bx + a = 0$ are $\alpha \text{ and } \beta$, then

A. $0 < \alpha < \frac{1}{2} \text{ and } -1 < \beta < 0$

B. $\alpha < \frac{1}{2} \text{ and } \beta < -1$

C. $\alpha > \frac{1}{2} \text{ and } \beta > -1$

D. $\alpha < 2 \text{ and } \beta > -1$

Answer: 1

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38. The quadratic equations $x^2 - 6x + a = 0 and x^2 - cx + 6 = 0$ have one root in common. The other roots of the first and second equations

are integers in the ratio 4 : 3. Then the common root is

A. both roots more than α

B. both roots less than α

C. one root more than α and other less than α

D. Can't say anything

Answer: 3

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39. If α and β, α and γ, α and δ are the roots of the equations $ax^2 + 2bx + c = 0$, $2bx^2 + cx + a = 0$ and $cx^2 + ax + 2b = 0$ respectively where a, b, c are positive real numbers, then $\alpha + \alpha^2$ is equal to

A. abc

B. a + 2b + c

C. -1

D. 0

Answer: 3

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40. If the equations $ax^2 + bx + c = 0$ and $x^3 + 3x^2 + 3x + 2 = 0$ have two common roots, then **a.** $a = b = c$ **b.** $a = b \neq c$ **c.** $a = -b = c$ **d.** none of these.

A. a = b = c

B. $a = b \neq c$

C. $a = -b = c$

D. none of these

Answer: 1

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41. The number of values of a for which equations $x^3 + ax + 1 = 0$ and $x^4 + ax^2 + 1 = 0$ have a common root is a) 0 b) 1 c) 2 d) Infinite

A. 0

B. 1

C. 2

D. infinite

Answer: B

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42. The number of value of k for which $\left[x^2 - (k-2)x + k^2\right] \times \left[x^2 + kx + (2k-1)\right]$ is a perfect square is 2 b. 1 c. 0 d. none of these

A. 2

B. 1

C. 0

D. none of these

Answer: 2

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43. The sum of the values of x satisfying the equation $\left(31+8\sqrt{15}\right)^{x^2-3}+1=\left(32+8\sqrt{15}\right)^{x^2-3}$ is

A. 3

B. 0

C. 2

D. none of these

Answer: 2

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44. The equation $\left(x^2+x=1\right)^2+1=\left(x^2+x+1\right)\left(x^2-x-5\right)$ for $x\in(-2,3)$ will have number of solutions. 1 b. 2 c. 3 d. 0

A. 1

B. 2

C. 3

D. zero

Answer: 4

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45. If α, β are the roots of $x^2+px+q=0andx^{2n}+p^nx^n+q^n=0andif(\alpha/\beta),(\beta/\alpha)$ are the roots of $x^n+1+(x+1)^n=0, the\cap(\in N)$ a. must be an odd integer b. may be any integer c. must be an even integer d. cannot say anything

A. must be an odd integer

B. may be any integer

C. must be an even integer

D. cannot say anything

Answer: 3

Watch Video Solution

46. If P(x) is a polynomial with integer coefficients such that for 4 distinct integers $a, b, c, d, P(a) = P(b) = P(c) = P(d) = 3$, if $P(e) = 5$, (e is an integer) then 1. e=1 , 2. e=3 , 3. e=4 , 4. No integer value of e

A. e = 1

B. e = 3

C. e = 4

D. no real value of e

Answer: 4

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47. Let $f(x) = x^2 + bx + c, whereb, c \in R.$ If $f(x)$ is a factor of both $x^4 + 6x^2 + 25and3x^4 + 4x^4 + 28x + 5$, then the least value of $f(x)$ is 2 **b.** 3 **c.** $5/2$ **d.** 4

A. 2

B. 3

C. $5/2$

D. 4

Answer: 4

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48. Consider the equation $x^2 + 2x - n = 0wheren \in Nandn \in [5, 100].$ The total number of

different values of n so that the given equation has integral roots is 8 **b.** 3

c. 6 **d.** 4

A. 8

B. 3

C. 6

D. 4

Answer: 1

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49. The total number of integral values of a so that $x^2-(a+1)x+a-1=0$ has integral roots is equal to **a.** 1 **b.** 2 **c.** 4 **d.** none of these

A. 1

B. 2

C. 4

D. none of these

Answer: 1

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50. The number of integral values of a for which the quadratic equation $(x+a)(x+1991)+1=0$ has integral roots are a. 3 b. 0 c. 1 d. 2

A. 3

B. 0

C. 1

D. 2

Answer: 4

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51. The number of real solutions of the equation $(9/10)^x = -3 + x - x^2$ is

A. 2

B. 0

C. 1

D. none of these

Answer: 2

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52. The number of real solutions of $|x| + 2\sqrt{5 - 4x - x^2} = 16$ is/are

A. 6

B. 1

C. 0

D. 4

Answer: 3

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53. Let $p(x) = 0$ be a polynomial equation of the least possible degree, with rational coefficients having $\sqrt[3]{7} + \sqrt[3]{49}$ as one of its roots. Then product of all the roots of $p(x) = 0$ is

a. 56 **b.** 63 **c.** 7 **d. 49**

A. 56

B. 63

C. 7

D. 49

Answer: 1

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54. If $\alpha, \beta, \gamma, \sigma$ are the roots of the equation $x^4 + 4x^3 - 6x^2 + 7x - 9 = 0$, then the value of $(1 + \alpha^2)(1 + \beta^2)(1 + \gamma^2)(1 + \sigma^2)$ is **a.** 9 **b.** 11 **c.** 13 **d.** 5

A. 9

B. 11

C. 13

D. 5

Answer: 3

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55. If $(m_r, \frac{1}{m_r})$ where r=1,2,3,4, are four pairs of values of x and y that satisfy the equation $x^2 + y^2 + 2gx + 2fy + c = 0$, then the value of $m_1 . m_2 . m_3 . m_4$ is

A. 0

B. 1

C. -1

D. none of these

Answer: 2

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56. If roots of an equation $x^n - 1 = 0 are 1, a_{1,2}, a_{n-1},$ then the value of $(1-a_1)(1-a_2)(1-a_3)(1-a_{n-1})$ will be n b. n^2 c. n^n d. 0

A. n

B. n^2

C. n^n

D. 0

Answer: 1

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57. If $\tan\theta_1, \tan\theta_2, \tan\theta_3$ are the real roots of the $x^2 - (a + 1x^2 + 1)(b - a)x - b = 0, where\theta_1 + \theta_2 + \theta_3 \in (0, \pi)$, then $\theta_1 + \theta_2 + \theta_3$, is equal to $\pi / 2$ **b.** $\pi / 4$ **c.** $3\pi / 4$ **d.** π

A. $\pi / 2$

B. $\pi / 4$

C. $3\pi / 4$

D. π

Answer: 2

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58. If α, β, γ are the roots of $x^3 - x^2 - 1 = 0$ then the value of $\frac{1+\alpha}{1-\alpha} + \frac{1+\beta}{1-\beta} + \frac{1+\gamma}{1-\gamma}$ is equal to

(a) -5 **b.** -6 **c.** -7 **d.** -2

A. -5

B. -6

C. -7

D. -2

Answer: A

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59. If $\alpha, \beta, \gamma, \delta$ are the roots of the equation $x^4 - Kx^3Kx^2 + Lx + m = 0, whereK, L, andM$ are real numbers, then the minimum value of $\alpha^2 + \beta^2 + \gamma^2 + \delta^2$ is 0 b. -1 c. 1 d. 2

A. 0

B. -1

C. 1

D. 2

Answer: 2

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60. Set of all real value of a such that $f(x)=\dfrac{(2a-1)x^2+2(a+1)x+(2a-1)}{x^2-2x+40}$ is always negative is a. $(-\infty, 0)$ b. $(0, \infty)$ c. $\left(-\infty, \dfrac{1}{2}\right)$ d. none

A. $(-\infty, 0)$

B. $(0, \infty)$

C. $(-\infty, 1/2)$

D. None

Answer: 1

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61. If $a, b \in R, a \neq 0$ and the quadratic equation $ax^2 - bx + 1 = 0$ has imaginary roots, then $(a + b + 1)$ is a. positive b. negative c. zero d. Dependent on the sign of b

A. positive

B. negative

C. zero

D. dependent on the sign of b

Answer: 1

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62. If the expression $[mx - 1 + (1/x)]$ is non-negative for all positive real x, then the minimum value of m must be $-1/2$ b. 0 c. $1/4$ d. $1/2$

A. $-1/2$

B. 0

C. $1/4$

D. $1/2$

Answer: 3

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63. Suppose that $f(x)$ is a quadratic expresson positive for all real x. If $g(x) = f(x) + f'(x) + f''(x)$, then for any real $x(where f'(x) and f''(x)$ represent 1st and 2nd derivative, respectively).

a. $g(x) < 0$ b. $g(x) > 0$ c. $g(x) = 0$ d. $g(x) \geq 0$

A. $g(x) < 0$

B. $g(x) > 0$

C. $g(x) = 0$

D. $g(x) \geq 0$

Answer: 2

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64. Let $a, b, c \in R$ with $a > 0$ such that the equation $ax^2 + bcx + b^3 + c^3 - 4abc = 0$ has non-real roots.

If $P(x) = ax^2 + bx + c$ and $Q(x) = ax^2 + cx + b$, then (a) $P(x) > 0$ for all $x \in R$ and $Q(x) < 0$ for all $x \in R$. (b) $P(x) < 0$ for all $x \in R$ and $Q(x) > 0$ for all $x \in R$. (c) neither $P(x) > 0$ for all $x \in R$ nor $Q(x) > 0$ for all $x \in R$. (d) exactly one of P(x) or Q(x) is positive for all real x.

A. $P(x) > 0$ for all $x \in R$ and $Q(x) < 0$ for all $x \in R$.

B. $P(x) < 0$ for all $x \in R$ and $Q(x) > 0$ for all $x \in R$.

C. neither $P(x) > 0$ for all $x \in R$ nor $Q(x) > 0$ for all $x \in R$.

D. exactly one of P(x) or Q(x) is positive for all real x.

Answer: 4

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65. Let $f(x) = ax^2 - bx + c^2, b \neq 0 \text{ and } f(x) \neq 0$ for all $x \in R$. Then

A. $a + c^2 < b$

B. $4a + c^2 > 2b$

C. $9a - 3b + c^2 < 0$

D. none of these

Answer: 2

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66. Let $f(x) = ax^2 + bx + c$a ,b ,c $\in R$. If $f(x)$ takes real values for real values of x and non-real values for non-real values of x , then (a)$a = 0$ (b) $b = 0$ (c) $c = 0$ (d) nothing can be said about a, b, c.

A. $a = 0$

B. $b = 0$

C. $c = 0$

D. nothing can be said about a, b, c.

Answer: 1

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67. If both roots of the equation $ax^2 + x + c - a = 0$ are imaginary and $c > -1$, then

A. $3a > 2 + 4c$

B. $3a < 2 + 4c$

C. $c < a$

D. none of these

Answer: 2

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68. If $\left(b^2-4ac\right)^2\left(1+4a^2\right)<64a^2, a<0$, then maximum value of quadratic expression ax^2+bx+c is always less than a. 0 b. 2 c. -1 d. -2

A. 0

B. 2

C. -1

D. -2

Answer: 2

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69. If the equation $\left|x^2+bx+c\right|=k$ has four real roots, then `b^2-4c >0a n d00a n dk >(4c-b^2)/4` none of these

A. $b^2-4c>0 \text{ and } -<k<\dfrac{4c-b^2}{4}$

B. $b^2-4c<0 \text{ and } -<k<\dfrac{4c-b^2}{4}$

C. $b^2-4c>0 \text{ and } -k>\dfrac{4c-b^2}{4}$

D. none of these

Answer: 1

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70. The set of value of a for which $(a-1)x^2(a+1)x+a-1\geq 0$ is true for all $x\geq 2$ is (a) $(-\infty, 1)$ b. $\left(1, \frac{7}{3}\right)$ c. $\left(\frac{7}{3}, \infty\right)$ d. none of these

A. $(-\infty, 1)$

B. $\left(1, \frac{7}{3}\right)$

C. $\left(\frac{7}{3}, \infty\right)$

D. none of these

Answer: 3

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71. If the equation $ax^2 + bx + c = x$ has no real roots, then the equation $a(ax^2 + bx + c)^2 + b(ax^2 + bx + c) + c = x$ will have a. four real roots b. no real root c. at least two least roots d. none of these

A. four real roots

B. no real root

C. al least two real roots

D. None of these

Answer: 2

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72. If $ax62 + bx + c = 0$ has imaginary roots and $a - b + c > 0$ then the set of points (x, y) satisfying the equation $\left|a\left(x^2 \frac{y}{a}\right) + (b+1)x + c\right| = \left|ax^2 + bx + c\right| + |x + y|$ consists of the region in the $xy - plane$ which is on or above the bisector of I and III quadrant on or above the bisector of II and IV quadrant on or below the

bisector of I and III quadrant on or below the bisector of II and IV quadrant

A. on or above the bisector of I and III quadrant

B. on or above the bisector of II and IV quadent

C. on or below the bisector of I and III quadrant

D. on or below the bisector of II and IV quadrant .

Answer: 2

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73. Given $x, y \in R, x^2 + y^2 > 0$. Then the range of $\frac{x^2 + y^2}{x^2 + xy + 4y^2}$ is (a) $\left(\frac{10 - 4\sqrt{5}}{3}, \frac{10 + 4\sqrt{5}}{3}\right)$ (b) $\left(\frac{10 - 4\sqrt{5}}{15}, \frac{10 + 4\sqrt{5}}{15}\right)$ (c) $\left(\frac{5 - 4\sqrt{5}}{15}, \frac{5 + 4\sqrt{5}}{15}\right)$ (d) $\left(\frac{20 - 4\sqrt{5}}{15}, \frac{20 + 4\sqrt{5}}{15}\right)$

A. $\left(\frac{10 - 4\sqrt{5}}{3}. \frac{10 + 4\sqrt{5}}{3}\right)$

B. $\left(\frac{10 - 4\sqrt{5}}{15}. \frac{10 + 4\sqrt{5}}{15}\right)$

C. $\left(\frac{5-4\sqrt{5}}{15}, \frac{5+4\sqrt{5}}{15}\right)$

D. $\left(\frac{20-4\sqrt{5}}{15}, \frac{20+4\sqrt{5}}{15}\right)$

Answer: 2

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74. x_1 **and** x_2 **are the roots of** $ax^2+bx+c=0$ **and** $x_1x_2<0$. **Roots of** $x_1(x-x_2)^2+x_2(x-x_1)^2=0$ **are: (a) real and of opposite sign b. negative c. positive d. none real**

A. real and opposite sign

B. negative

C. positive

D. nonreal

Answer: 1

Watch Video Solution

75. If a, b, c, d are four consecutive terms of an increasing A.P., then the roots of the equation $(x-a)(x-c)+2(x-b)(x-d)=0$ are

a. non-real complex

b. real and equal

c. integers

d. real and distinct

A. non-real complex

B. real and equal

C. integers

D. real and disinct

Answer: 4

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76. If roots of $x^2 - (a-3)x + a = 0$ are such that at least one of them is greater than 2, then a. $a \in [7, 9]$ b. $a \in [7, \infty]$ c. $a \in [9, \infty)$ d. $a \in [7, 9]$

A. $a \in [7, 9]$

B. $a \in [7, \infty)$

C. $a \in [9, \infty)$

D. $a \in [7, 9)$

Answer: 3

Watch Video Solution

77. All the values of m for which both roots of the equation $x^2 - 2mx + m^2 - 1 = 0$ are greater than -2 but less then 4 lie in the interval

A. $-2 < m < 0$

B. $m > 3$

C. $-1 < m < 3$

D. $1 < m < 4$

Answer: 3

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78. if the roots of the quadratic equation $(4p - p^2 - 5)x^2 - 2mx + m^2 - 1 = 0$ are greater then - 2 less then 4 lie in the interval

A. 1

B. 2

C. 3

D. 4

Answer: 2

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79. The interval of a for which the equation $tan^2 x - (a-4)\tan x + 4 - 2a = 0$ has at least one solution $\forall x \in [0, \pi/4]$

a) $a \in (2, 3)$

b. $a \in [2, 3]$

c. $a \in (1, 4)$

d. $a \in [1, 4]$

A. $a \in (2, 3)$

B. $a \in [2, 3]$

C. $a \in (1, 4)$

D. $a \in [1, 4]$

Answer: 2

Watch Video Solution

80. The range of a for which the equation $x^2 + x - 4 = 0$ has its smaller root in the interval $(-1, 2) is$ $(-\infty, -3)$ b. $(0, 3)$ c. $(0, \infty)$ d. $(-\infty, -3) \cup (0, \infty)$

A. $(-\infty, -3)$

B. (0, 3)

C. $(0, \infty)$

D. $(-\infty, -3) \cup (0, \infty)$

Answer: A

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81. Find the set of all possible real value of a such that the inequality $(x - (a-1))(x - (a^2 + 2)) < 0$ holds for all $x \in (-1, 3)$.

A. $(0, 1)$

B. $(\infty, -2]$

C. $(-\infty, -1)$

D. $(1, \infty)$

Answer: 2

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82. If the equation $cof^4 x - 2\cos ec^2 x + a^2 = 0$ has at least one solution, then the sum of all possible integral values of a is equal to a. 4 b. 3 c. 2 d. 0

A. 4

B. 3

C. 2

D. 0

Answer: 4

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83. If a, b, c are distinct positive numbers, then the nature of roots of the equation $1/(x-a)+1/(x-b)+1/(x-c)=1/x$ is all real and is distinct all real and at least two are distinct at least two real d. all non-real

A. all real and distinct

B. all real and at least two are distinct

C. al least two real

D. all non-real

Answer: 1

Watch Video Solution

84. For $x^2-(a+3)|x|+4=0$ to have real solutions, the range of a is

a. $(-\infty, -7] \cup [1, \infty)$ b. $(-3, \infty)$ c. $(-\infty, -7)$ d. $[1, \infty)$

A. $(-\infty, -7][1, \infty)$

B. $(-3, \infty)$

C. $(-\infty, -7]$

D. $[1, \infty)$

Answer: 4

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85. If the quadratic equation $4x^2 - 2(a + c - 1)x + ac - b = 0(a > b > c)$ Both roots se greater than a Both roots are less than c Both roots lie between $c/2 and a/2$ Exactly one of the roots lies between $c/2 and a/2$

A. both roots are greater then a

B. both roots are less then c

C. both roots lie between $c/2 \text{ and } a/2$

D. exactly one of the roots lies between $c/2 \text{ and } a/2$.

Answer: 4

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86. If the equaion $x^2 + ax + b = 0$ has distinct real roots and $x^2 + a|x| + b = 0$ has only one real root, then

A. $b = 0, a > 0$

B. b = 0, a $<$ 0

C. $b > 0, a < 0$

D. $b < 0, a > 0$

Answer: 1

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87. The equation $2^{2x} + (a - 1)2^{x+1} + a = 0$ has roots of opposite sing, then exhaustive set of values of a is

A. $a \in (-1, 0)$

B. $a < 0$

C. $a \in (-\infty, 1/3)$

D. $a \in (0, 1/3)$

Answer: 3

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88. All the values of $'a'$ for which the quadratic expression $ax^2 + (a-2)x - 2$ is negative for exactly two integral values of x may lie in (a) $\left[1, \frac{3}{2}\right]$ (b) $\left[\frac{3}{2}, 2\right)$ (c) $[1, 2)$ (d) $[-1, 2)$

A. (0,2)

B. [1,2)

C. (1, 2]

D. (0,2]

Answer: 2

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89. If a_0, a_1, a_2, a_3 are all the positive, then $4a_0x^3 + 3a_1x^2 + 2a_2x + a_3 = 0$ has least one root in $(-1, 0)$ if

A. $a_0 + a_2 = a_1 + a_3$ and $4_{a_0} + 2a_2 > 3a_1 + a_3$

B. $4a_0 + 2a_2 < 3a_1 + a_3$

C. $4a_0 + 2a_2 = 3a_1 + a_3$ and $a_0 + a_2 < a_1 + a_3$

D. none of these

Answer: 1

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Multiple Correct Answer Type

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

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

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

C. a+ b

D. a - b

Answer: 1.2

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2. If α, β are the roots of the quadratic equation $ax^2 + bx + c = 0$, then which of the following expression will be the symmetric function of roots

a. $\left|\log\left(\frac{\alpha}{\beta}\right)\right|$ b. $\alpha^2\beta^5 + \beta^2\alpha^5$ c. $tan(\alpha - \beta)$ d. $\left(\log\left(\frac{1}{\alpha}\right)\right)^2 + (\log \beta)^2$

A. $\left|\log \frac{\alpha}{\beta}\right|$

B. $\alpha^2\beta^5 + \beta^2\alpha^5$

C. $\tan(\alpha - \beta)$

D. $\left(\log\frac{1}{\alpha}\right)^2 + (\log\beta)^2$

Answer: 1,2,4

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3. If one root of the quadratic equation $px^2 + qx + r = 0 (p \neq 0)$ is a surd $\frac{\sqrt{a}}{\sqrt{a} + \sqrt{a - b},}$ where $p, q, r; a, b$ are all rationals then the other root is -

A. $\frac{\sqrt{a}}{\sqrt{a} - \sqrt{a - b}}$

B. $\frac{\sqrt{a} - \sqrt{a - b}}{\sqrt{b}}$

C. $a + \frac{\sqrt{a(a - b)}}{b}$

D. $\frac{a + \sqrt{a(a - b)}}{b}$

Answer: 1,4

View Text Solution

4. If a, b, c real in G.P., then the roots of the equation $ax^2+bx+c=0$ are in the ratio a. $\frac{1}{2}(-1+i\sqrt{3})$ b. $\frac{1}{2}(1-i\sqrt{3})$ $c\frac{1}{2}(-1-i\sqrt{3})$ d. $\frac{1}{2}(1+i\sqrt{3})$

A. $\frac{1}{2}(-1+i\sqrt{3})$

B. $\frac{1}{2}(1-i\sqrt{3})$

C. $\frac{1}{2}(-1-i\sqrt{3})$

D. $\frac{1}{2}(1+i\sqrt{3})$

Answer: 1,3

Watch Video Solution

5. the roots of the equation $(a+\sqrt{b})^{x^2-15}+(a-\sqrt{b})^{x^2-15}=2a$ where $a^2-b=1$ are

A. ± 4

B. ± 3

C. $\pm\sqrt{14}$

D. $\pm\sqrt{5}$

Answer: 1,3

Watch Video Solution

6. If the equations $x^2 + px + q = 0$ and $x^2 + p'x + q' = 0$ have a common root, then it must be equal to a. $\frac{p' - p'q}{q - q'}$ b. $\frac{q - q'}{p' - p}$ c. $\frac{p' - p}{q - q'}$ d. $\frac{pq' - p'q}{p - p'}$

A. $\frac{pq' - p'q}{q - q'}$

B. $\frac{q - q'}{p' - p}$

C. $\frac{p' = p}{q - q'}$

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

Answer: 1,2

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7. If the quadratic equation $ax^2 + bx + c = 0(a > 0)$ has $\sec^2 \theta and \cos ec^2\theta$ as its roots, then which of the following must hold good? $b + c = 0$ **b.** $b^2 - 4ac \geq 0$ **c.** $\geq 4a$ **d.** $4a + b \geq 0$

A. $b + c = 0$

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

C. $c \geq 4a$

D. $4ab \geq 0$

Answer: 1,2,3

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8. Given that α, γ are roots of the equation $Ax^2 - 4x + 1 = 0, and\beta, \delta$ the roots of the equation of $Bx^2 - 6x + 1 = 0,$ such that $\alpha, \beta, \gamma, and\delta$ are in H.P., then a.$A = 3$ b. $A = 4$ $B = 2$ d. $B = 8$

A. A = 3

B. A = 4

C. B = 2

D. B = 8

Answer: 1,4

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9. If $\cos^4\theta + \alpha$ are the roots of the equation $x^2 + 2bx + b = 0 and \cos^2\theta + \beta, \sin^2\theta + \beta are$ the roots of the equation $x^2 + 4x + 2 = 0,$ then values of b are 2 b. -1 c. -2 d. 2

A. 2

B. -1

C. -2

D. 1

Answer: 1,2

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10. If α, β are the roots of the equation $ax^2 + bx + c = 0$ then the roots of the equation $(a + b + c)x^2 - (b + 2c)x + c = 0$ are

A. c

B. d - c

C. 2c

D. 0

Answer: 2,4

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11. If every pair of equations $x^2 + ax + bc = 0, x^2 + bx + ca = 0$ and $x^2 + cx + ab = 0$ has a common root then their sum is

A. the sum of the three common roots is $-(1/2)(a+b+c)$

B. the sum of the three common roots is $2(a+b+c)$

C. one of the values of the product of the three common

roots is abc

D. the product of the three common roots is $a^2b^2c^2$

Answer: 1,3

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12. If the equation $4x^2 - x - 1 = 0$ and $3x^2 + (\lambda + \mu)x + \lambda - \mu = 0$ have a root common, then the irrational values of λ and μ are (a) $\lambda = \frac{-3}{4}$ b. $\lambda = 0$ c. $\mu = \frac{3}{4}$ b.$\mu = 0$

A. $\lambda = \frac{-3}{4}$

B. $\lambda = 0$

C. $\mu = \frac{3}{4}$

D. $\mu = 0$

Answer: 1,4

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13. If $x^3 + 3x^2 - 9x + c$ is of the form $(x - \alpha)^2(x - \beta)$ then c is equal to

A. 27

B. -27

C. 5

D. -5

Answer: 2,3

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14. If the equation whose roots are the squares of the roots of the cubic $x^3 - ax^2 + bx - 1 = 0$ is identical with the given cubic equation, then

(A) $a=0, b=3$ (B) $a=b=0$ (C) $a=b=3$ (D) $a, b,$ are roots of $x^2+x+2=0$

A. $a=0, b=3$

B. a = b = 0

C. a = b = 3

D. a, b are roots of $x^2+x+2=0$

Answer: 2,3,4

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15. If $f(x)$ is a polynomial of degree 4 with rational coefficients and touches x - axis at $(\sqrt{2}, 0)$, then for the equation $f(x)=0$,

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16. Roots of this equation are, $\left(x^3 + \frac{1}{x^3}\right) + \left(x^2 + \frac{1}{x^2}\right) - 6\left(x + \frac{1}{x}\right) - 7 = 0$

A. $\frac{3+\sqrt{5}}{2}$

B. $\frac{-3-\sqrt{5}}{2}$

C. $\frac{3-\sqrt{5}}{2}$

D. $\frac{-3+\sqrt{5}}{2}$

Answer: 1,2,3,4

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17. $2x^2 + 6xy + 5y^2 = 1, then$

A. $|x| \leq \sqrt{5}$

B. $|x| \geq \sqrt{5}$

C. $y^2 \leq 2$

D. $y^2 \leq 4$

Answer: 1,3

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18. If $f(x) = ax^2 + bx + c$, where $a \neq 0, b, c \in$ R, then which of the following conditions implies that f(x) has real roots?

A. a+ b + c = 0

B. a and c are of opposite signs

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

D. a and b are of opposite signs

Answer: 1,2,3,

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19. If $\dfrac{x^2+5}{2}=x-2$ cos (m + n)` has at least one real root, the

A. number of possible values of x is two

B. number of possible values of x is one

C. the value of $m+n$is $(2n+1)\pi$

D. the value of m +n is $2n\pi$

Answer: 2,3,

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20. Let three quadratic equations $ax^2-2bx+c=0, bx^2-2cx+a=0$ and $cx^2-2ax+b=0$, all have only positive roots. Then ltbr. Which of these are always ture?

A. $b^2=ac$

B. $c^2=ab$

C. each pair of equations has exactly one root common

D. each pair of equations has two roots common

Answer: 1,2,4

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21. For the quadratic equation $x^2 + 2(a+1)x + 9a - 5 = 0,$ which of the following is/are true? (a) If $2 < a < 5$, then roots are opposite sign (b)If $a < 0$, then roots are opposite in sign (c) if $a > 7$ then both roots are negative (d) if $2 \le a \le 5$ then roots are unreal

A. If $2 < a < 5$, then roots are of opposite sign .

B. If $a < 0,$ then roots are of opposite sign

C. If $a > 7$, then both roots are negative .

D. If $2 \le a \le 5$, then roots are unreal.

Answer: 2,3,4

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22. If $a, b, c \in Randabc < 0$, then equation $bcx^2 + 2b + c - a)x + a = 0has$ both positive roots both negative roots real roots one positive and one negative root

A. both positive roots

B. both negatie roots

C. real roots

D. one positive and one negative root

Answer: 3,4

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23. The graph of the quadratic trinomial $u = ax^2 + bx + c$ has its vertex at (4, -5) and two x-intercepts, one positive and one negative. Which of the following holds good? a. $a > 0$ b. $b < 0$ c. $c < 0$ d. $8a = b$

A. $a > 0$

B. $b < 0$

C. $c < 0$

D. $8a = b$

Answer: 1,2,3

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24. Let $a, b, c \in Q^{+}$ satisfying $a > b > \cdot$ Which of the following statements (s) hold true of the quadratic polynomial $f(x) = (a+b-2c)x^2 + (b+c-2a)x + (c+a-2b)$? The mouth of the parabola $y = f(x)$ opens upwards Both roots of the equation $f(x) = 0$ are rational The x-coordinate of vertex of the graph is positive The product of the roots is always negative

A. The mouth of the parabola f(x) = 0 opens upwards

B. Both roots of the equation f(x) = 0 are rational

C. The x-coordinate of vertex of the graph is positive

D. The product of the roots is always negative .

Answer: 1,2,3,

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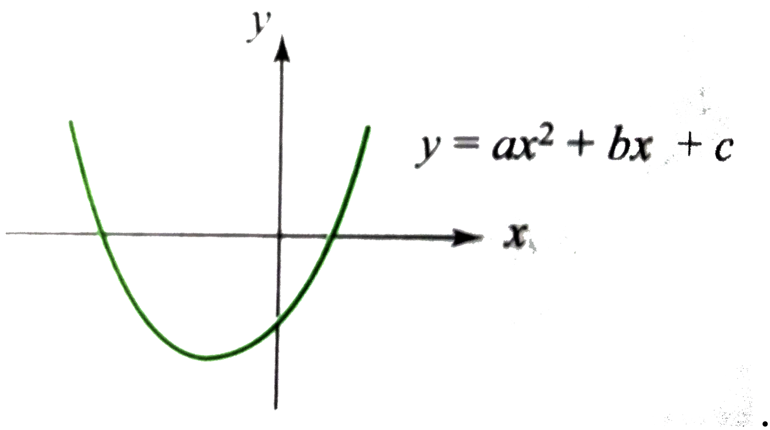
25. Let $f(X) = ax^2 + bx + c$. Consider the following diagram



A. $c < 0$

B. $b > 0$

C. $a + b - c > 0$

D. $abc < 0$

Answer: 1,2,3,4

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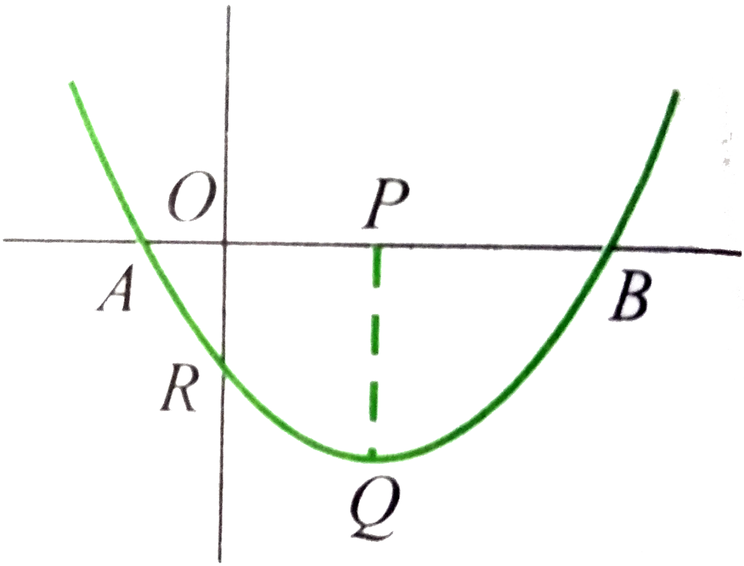
26. Graph of y = ax^(2) + bx + c is as shown in the figure . If $PQ = 9$, $OR = 5$ and $OB = 2.5$, the which of the following is /are ture?



A. (a) $AB = 3$

B. (b) $y(-1) < 0$

C. (c) $(y \geq 7) f$ or $all x \geq 3$

D. (d) $ax^2 + bx + c =$ mx has real

roots for all real m

Answer: 1,3,4

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27. $ax^2 + bx + c = 0 (a > 0),$ has two roots α and β such $\alpha < -2$ and $\beta > 2,$ then

A. $a - |b| + c < 0$

B. $c < 0, b^2 - 4ac > 0$

C. $4a - 2|b| + c < 0$

D. $9a - 3|b| + c < 0$

Answer: 1,2,3

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28. If the equation $ax^2 + bx + c = 0, a, b, c, \in$ R have non -real roots, then

A. $c(a - b + c) > 0$

B. $c(a + b + c) > 0$

C. $c(4a - 2b + c) > 0$

D. none of these

Answer: 1,2,3

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29. If $\cos x - y^2 - \sqrt{y - x^2 - 1} \geq 0$, then

A. $y \geq 1$

B. $x \in$ R

C. $y = 1$

D. $x = 0$

Answer: 3,4

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30. If $ax^2 + (b - c)x + a - b - c = 0$ has unequal real roots for all $c \varepsilon R$, then

A. $b < 0 < a$

B. $a < 0 < b$

C. $b < a < 0$

D. $b > a > 0$

Answer: 3,4

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31. If $\frac{x^2 + ax + 3}{x^2 + x + a}$ takes all real values for possible real values of x, then **a.** $a^3 - 9a + 12 \leq 0$ **b.** $4a^5 + 39 \geq 0$ **c.** $a \geq \frac{1}{4}$ **d.** $a < \frac{1}{4}$

A. -3

B. 2

C. -1

D. -4

Answer: 1,4

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32. If the range of function $f(x) = \frac{x+1}{k + x^2}$ contains the interval [-0,1] , then values of k can be equal to

A. 0

B. 0.5

C. 1.25

D. 1.5

Answer: 1,2,3

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33. Consider equation $(x - \sin\alpha)(x - \cos\alpha) - 2 = 0$. Which of the following is /are true?

A. If $0 < \alpha < \frac{\pi}{4}$, then the equation has both roots in $(\sin\alpha, \cos\alpha)$

B. If $\frac{\pi}{4} < \alpha\frac{\pi}{2}$, then the equations has both roots in $(\sin\alpha, \cos\alpha\infty)$

C. If $0 < \alpha < \frac{\pi}{4}$, the one roots lies in $(-\infty, \sin\alpha)$ and the other in $(\sin\alpha, \infty)$

D. If $\frac{\pi}{4} < \alpha < \frac{\pi}{2}$ then one root lies in $(-\infty, \cos\alpha)$ and the other is $(\sin\alpha, \infty)$

Answer: 3,4

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34. If the roots of the equation, $x^3 + px^2 + qx - 1 = 0$ form an increasing $G.P.$ where p and q are real,then (a) $p + q = 0$ (b) $p \in (-3, \infty)$ (c) one of the roots is unity (d) one root is smaller than 1 and one root is greater than 1

A. $p + q = 0$

B. $\pi n(-3, \infty)$

C. one of the roots is untiy

D. one roots is smaller than 1 and one roots is greater than 1

Answer: 1,3,4

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35. Consider a quadratic equation $ax^2 + bx + c = 0$ having roots α, β. If $4a + 2b + c > 0$, $a - b + c < 0$ and $4a - 2b + C > 0$ then $|[\alpha] + [\beta]|$ can be {where [] is greatest integer}

A. -2

B. -1

C. 0

D. 1

Answer: 1,2,3

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36. The equation $\left(\frac{x}{x+1}\right)^2+\left(\frac{x}{x-1}\right)^2=a(a-1)$ has

a. Four real roots if $a>2$

b.Four real roots if $a<-1$

c. Two real roots if $1<a<2$

d . No real roots if $a<-1$

A. four real roots if $a>2$

B. four real roots if $a<-1$

C. two real roots if $1<a<2$

D. no real root if a < -1

Answer: 1,2,3

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37. If the quadratic equations $x^2 + bx + c = 0$ and $bx^2 + cx + 1 = 0$ have a common root then prove that either $b + c + 1 = 0$ or $b^2 + c^2 + 1 = bc + b + c$.

A. $b + c + 1 = 0$

B. $b^2 + c^2 - 1 = bc - b - c$

C. $b + c - 1 = 0$

D. $b^2 + c^2 + 1 = bc + b + c$

Answer: 1,4

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38. If the inequality $\cot^2 x + (k+1)\cot x - (k-3) < 0$ is true for at least one $x \in (0, \pi/2)$, then $k \in$.

A. $(-\infty, 3-2\sqrt{5})$

B. $(3, \infty)$

C. $(-1, \infty)$

D. $(-\infty, 3)$

Answer: 1,2

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Linked Comprehension Type

1. Consider an unknow polynomial which divided by $(x-3)$ and $(x-4)$ leaves remainder 2 and 1, respectively. Let R(x) be the remainder when this polynomial is divided by $(x-3)(x-4)$.

If equations $R(x) = x^2 + ax + 1$ has two distint real roots, then exhaustive values of a are.

A. $(-2, 2)$

B. $(-\infty, -2) \cup (2, \infty)$

C. $(-2, \infty)$

D. all real numbers

Answer: 4

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2. Consider an unknow polynomial which divided by $(x-3)$ and $(x-4)$ leaves remainder 2 and 1, respectively. Let R(x) be the remainder when this polynomial is divided by $(x-3)(x-4)$.

If equations $R(x) = x^2 + ax + 1$ has two distint real roots, then exhaustive values of a are.

A. -2

B. $2/3$

C. $-1/3$

D. none of these

Answer: 3

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3. If a polynomial f (x) is divided by $(x-3)$ and $(x-4)$ it leaves remainders as 7 and 12 respectively, then find the remainder when f (x) is divided by $(x-3)(x-4)$

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4. Let $f(x)=x^2+bx+c$ and $g(x)=x^2+b_1x+c_1$

Let the real roots of $f(x)=0$ be α, β and real roots of $g(x)=0$ be $\alpha+k, \beta+k$ fro same constant k. The least value fo $f(x)$ is $-\frac{1}{4}$ and least value of $g(x)$ occurs at $x = \frac{7}{2}$

The valueof b_1 is

A. $-\frac{1}{4}$

B. -1

C. $-\frac{1}{3}$

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

Answer: 1

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5. Let $f(x) = x^2 + bx + c$ and $g(x) = x^2 + b_1 x + c_1$

Let the real roots of $f(x) = 0$ be α, β and real roots of $g(x) = 0$ be $\alpha + k, \beta + k$ fro same constant k. The least value fo $f(x)$ is $-\frac{1}{4}$ and least value of $g(x)$ occurs at $x = \frac{7}{2}$

The valueof b_1 is

A. -5

B. 9

C. -8

D. -7

Answer: 4

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6. Let $f(x)=x^2+bx+c$ and $g(x)=x^2+b_1x+c_1$

Let the real roots of $f(x)=0$ be α, β and real roots of $g(x)=0$ be $\alpha+k, \beta+k$ fro same constant k. The least value fo $f(x)$ is $-\frac{1}{4}$ and least value of $g(x)$ occurs at $x=\frac{7}{2}$

The valueof b_1 is

A. $3, \ -4$

B. $-3, 4$

C. $3, \ -4$

D. $-3, \ -4$

Answer: 3

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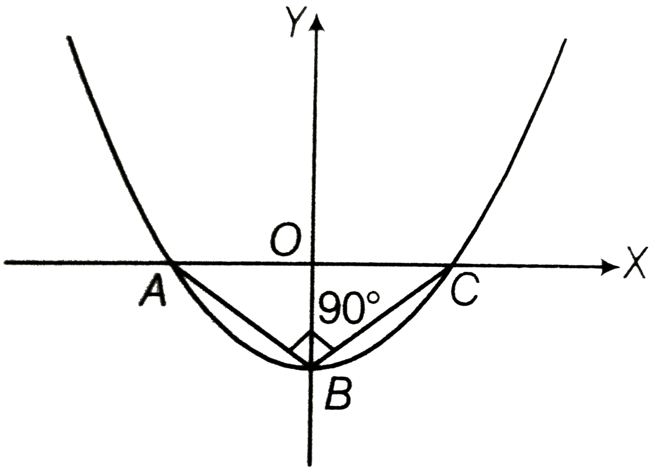
7. In the given figue vertices of ΔABC lie on $y = f(x) = ax^2 + bx + c$. The ΔAB is right angled isosceles triangle whose hypotenuse $AC = 4\sqrt{2}$ units.



Number of integral value of λ for which $\frac{\lambda}{2}$ lies between the roots of $f(x) = 0$, is

A. $y = x^2 - 2\sqrt{2}$

B. $y = x^2 - 12$

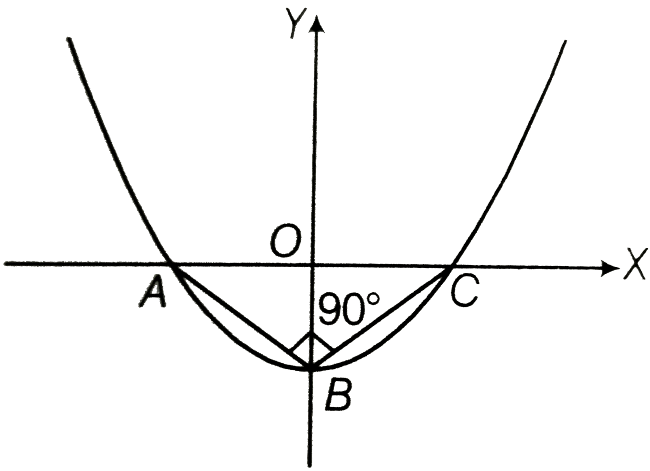
C. $y = \frac{x^2}{2} - 2$

D. $y = \frac{x^2}{2\sqrt{2}} - 2\sqrt{2}$

Answer: 4

View Text Solution

8. In the given figue vertices of ΔABC lie on $y = f(x) = ax^2 + bx + c$. The ΔAB is right angled isosceles triangle whose hypotenuse $AC = 4\sqrt{2}$ units.



Number of integral value of λ for which $\frac{\lambda}{2}$ lies between the roots of $f(x) = 0$, is

A. -4

B. -2

C. $-2\sqrt{2}$

D. none of these

Answer: 3

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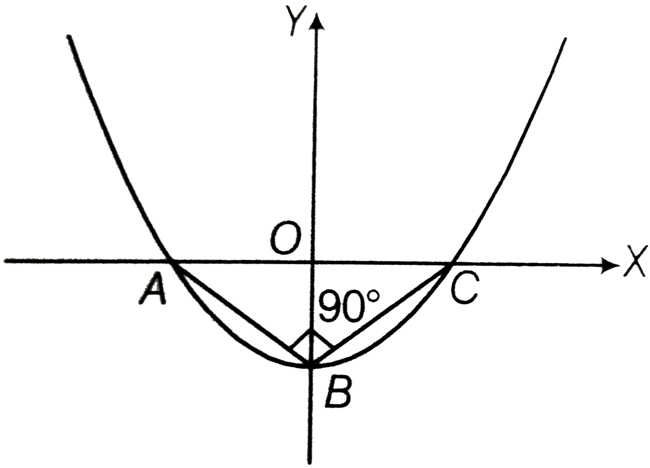
9. In the given figue vertices of ΔABC lie on $y = f(x) = ax^2 + bx + c$. The ΔAB is right angled isosceles triangle whose hypotenuse $AC = 4\sqrt{2}$ units.



Number of integral value of λ for which $\frac{\lambda}{2}$ lies between the roots of $f(x) = 0$, is

A. 6

B. 4

C. 5

D. 7

Answer: 3

View Text Solution

10. Let $f(x) = 4x^2 - 4ax + a^2 - 2a + 2$ be a quadratic polynomial in x, a be any real number. If x-coordinate of vertex of parabola y =f(x) is less than 0 and f(x) has minimum value 3 for $x \in [0, 2]$ then value of a is (a) $1 + \sqrt{2}$ (b) $1 - \sqrt{2}$ (c) $1 - \sqrt{3}$ (d) $1 + \sqrt{3}$

A. 1

B. 2

C. 3

D. 0

Answer: 2

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11. Let $f(x) = 4x^2 - 4ax + a^2 - 2a + 2$ be a quadratic polynomial in x,a be any real number. If x-coordinate ofd vertex of parabola y =f(x) is less thna 0 and f(x) has minimum value 3 for $x \in [0, 2]$ then value of a is

A. 1

B. 2

C. 3

D. 0

Answer: 4

View Text Solution

12. Let $f(x) = 4x^2 - 4ax + a^2 - 2a + 2$ such that minimum value fo the $f(x)$ for $x \in [0, 2]$ is equal to 3.

Number of values of a for which global minimum value, that is equal to 3 for $x \in [0, 2]$, occurs for the value of x lying in (0,2) is

A. $a \leq 0 \text{ or } a \geq 4$

B. $0 \leq a \leq 4$

C. $a \geq 0$

D. none of these

Answer: 1

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13. Consdier the equaiton $2 + \ | x^2 + 4x + 3_{=} m, m \in R$

Set of all values of m so that the given equaition have two solutions is

A. $\{3\}$

B. $\{2\}$

C. $\{1\}$

D. $\{0\}$

Answer: 1

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14. Consdier the equaiton $2 + |x^2 + 4x + 3| = m, m \in R$ Set of all real values of m so that given equation have four distinct solutions, is

A. $(0, 1)$

B. $(1, 2)$

C. $(1, 3)$

D. $(2, 3)$

Answer: 4

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15. Consdier the equaiton $2 + \left|x^2 + 4x + 3\right| = m, m \in R$ Set of all values of m so that the given equaition have two solutions is

A. $(3, \infty)$

B. $(2, \infty)$

C. $\{2\} \cup (3, \infty)$

D. None of these

Answer: 3

Watch Video Solution

16. If $ax^2 + bx + c = 0$ have two distinct roots lying int eh interval $(0, 1), a, b, ce\pi slon N$

The least value of a is

A. 4

B. 6

C. 7

D. 5

Answer: 4

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17. Consider the quadration$ax^2 - bx + c = 0, a, b, c \in N$ which has two distinct real roots belonging to the interval (1,2).

The least value of b is

A. 10

B. 11

C. 13

D. 15

Answer: 2

View Text Solution

18. Consider the quadration$ax^2 - bx + c = 0, a, b, c \in N$ which has two distinct real roots belonging to the interval (1,2).

The least value of b is

A. 4

B. 6

C. 7

D. 5

Answer: 2

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19. Consider the inequation $x^2 + x + a - 9 < 0$

The values of the real parameter a so that the given inequaiton has at least one positive solution:

A. $(-\infty, 37/4)$

B. $(-\infty, \infty)$

C. $(3, \infty)$

D. $(-\infty, 9)$

Answer: 4

Watch Video Solution

20. Consider the inequation $x^2 + x + a - 9 < 0$

The values of the real parameter a so that the given inequations has at least one negative solution.

A. $(-\infty, 9)$

B. $\left(\frac{37}{4}, \infty\right)$

C. $\left(-\infty, \frac{37}{4}\right)$

D. none of these

Answer: 3

Watch Video Solution

21. Consider the inequation $x^2 + x + a - 9 < 0$

The value of the parameter a so that the given inequaiton is ture $\forall x \in (-1, 3)$

A. $(-\infty, -3]$

B. $(-3, \infty)$

C. $[9, \infty)$

D. $(-\infty, 34/4)$

Answer: 1

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22. Consider the inequation $9^x - a3^x - a + 3 \leq 0$, where a is real parameter.

The given inequality has at least one negative solution for $a \in$ (a) $(-\infty, 2)$ (b) $(3, \infty)$ (c) $(-2, \infty)$ (d) $(2, 3)$

A. $(-\infty, 2)$

B. $(3, \infty)$

C. $(-2, \infty)$

D. $(2, 3)$

Answer: 4

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23. Consider the inequality $9^x - a \cdot 3^x - a + 3 \leq 0$, where a is a real parameter.

The given inequality has at least one positive solution for $a \in$

A. $(-\infty, -2)$

B. $[3, \infty)$

C. $(2, \infty)$

D. $[-2, \infty)$

Answer: 3

Watch Video Solution

24. Consider the inequality $9^x - a \cdot 3^x - a + 3 \leq 0$, where a is a real parameter.

The given inequality has at least one positive solution for $a \in$

A. $(-\infty, 3)$

B. $[2, \infty)$

C. $(3, \infty)$

D. $[-2, \infty)$

Answer: 2

Watch Video Solution

25. $(af(\mu) < 0)$ is the necessary and sufficient condition for a particular real number μ to lie between the roots of a quadratic equations $f(x) = 0$, where $f(x) = ax^2 + bx + c$. Again if $f(\mu_1)f(\mu_2) < 0$, then exactly one of the roots will lie between μ_1 and μ_2.

If $|b| > |a + c|$, then

A. one roots of f(x)=0 is positive, the other is negative

B. exactly one of the roots of f(x) = 0 lie in (-1,1)

C. 1 lies between the roots of f(x) = 0

D. both the roots of f(x) = 0 are less than 1

Answer: 2

Watch Video Solution

26. $(af(\mu) < 0)$ is the necessary and sufficient condition for a particular real number μ to lie between the roots of a quadratic equations $f(x) = 0,$ where $f(x) = ax^2 + bx + c$. Again if $f(\mu_1)f(\mu_2) < 0$, then exactly one of the roots will lie between μ_1 and μ_2.

If $c(a + b + c) < 0 < (a + b + c)a$, then

A. one roots is less than 0, the is posititve, the other is negative.

B. exactly one of the roots lies in (0,1)

C. both the roots lie in (0,1)

D. at least one of the roots lies in (0,1)

Answer: 1

Watch Video Solution

27. $(af(\mu) < 0)$ is the necessary and sufficient condition for a particular real number μ to lie between the roots of a quadratic equations $f(x) = 0,$ where $f(x) = ax^2 + bx + c$. Again if $f(\mu_1)f(\mu_2) < 0$, then exactly one of the roots will lie between μ_1 and μ_2.

If $c(a + b + c) < 0 < (a + b + c)a$, then

A. one roots is less than 0, the other is greater than 1

B. one roots lies in $(-\infty, 0)$ and other in $(0, 1)$

C. both the roots lie in $(0, 1)$

D. one roots lies in (0,1) and other in $(1, \infty)$

Answer: 2

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28. If the roots of the equation $ax^2 + bx + c = 0 (a \neq 0)$ be equal then

A. (a) $|p| \geq |P|$

B. (b) $|p| \leq |P|$

C. (c) $|p| = |P|$

D. (d) All of these

Answer: 2

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29. If $(x+2)$ is a common factor of $(px^2 + qx + r)$ and $(qx^2 + px + r)$ then (a) $p = q$ or $p + q + r = 0$ (b)$p = r$ or $p + q + r = 0$ (c) $q = r$ or $p + q + r = 0$ (d)$p = q = -\frac{1}{2}r$

A. $|d| \leq |D|$

B. $|d| \geq |D|$

C. $|d| = |D|$

D. None of these

Answer: 1

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30. Consider the equation $x^4 + 2ax^3 + x^2 + 2ax + 1 = 0$, where $a \in R$. If exactly two roots are positive and two roots are negative, then the number of intergal values of a is

A. $(-\infty, -1/4)$

B. $(5/4, \infty)$

C. $(-\infty, -3/4)$

D. none of these

Answer: 3

Watch Video Solution

31. Consider the equation $x^4 + 2ax^3 + x^2 + 2ax + 1 = 0$, where $a \in R$.

If exactly two roots are positive and two roots are negative, then the number of intergal values of a is

A. $(3/4, \infty)$

B. $(-5/4, \infty)$

C. $(-\infty, 1/4)$

D. none of these

Answer: 1

Watch Video Solution

32. Consider the equation $x^4 + 2ax^3 + x^2 + 2ax + 1 = 0$ where $a \in R$.

Also range of function $f(x) = x + \frac{1}{x}$ is $(-\infty, -2] \cup [2, \infty)$ If equation has at least two distinct positive real roots then all possible values of a are

A. 2

B. 1

C. 0

D. 3

Answer: 3

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33. The real numbers x_1, x_2, x_3 satisfying the equation $x^3 - x^2 + bx + \gamma = 0$ are in A.P. Find the intervals in which β and γ lie.

A. $\left(-\infty, \frac{1}{3}\right)$

B. $\left(-\infty, -\frac{1}{3}\right)$

C. $\left(\frac{1}{3}, \infty\right)$

D. $\left(-\frac{1}{3}, \infty\right)$

Answer: 1

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34. The real numbers x_1, x_2, x_3 satisfying the equation $x^3 - x^2 + bx + \gamma = 0$ are in A.P. Find the intervals in which β and γ lie.

A. $\left(-\frac{1}{9}, \infty\right)$

B. $\left(-\frac{1}{27}, +\infty\right)$

C. $\left(\frac{2}{9}, +\infty\right)$

D. none of these

Answer: 2

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35. If the equation $x^4 - \lambda x^2 + 9 = 0$ has four real and distinct roots, then λ lies in the interval

A. $(-\infty, -6) \cup (6, \infty)$

B. $(0, \infty)$

C. $(6, \infty)$

D. $(-\infty, -6)$

Answer: C

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36. If the equation has no real root, then λ lies in the interval

A. $(-\infty, 0)$

B. $(-\infty, 6)$

C. $(6, \infty)$

D. $(0, \infty)$

Answer: B

Watch Video Solution

37. If the equation $x^4 - \lambda x^2 + 9 = 0$ has only two real roots, then the set of values of λ is

A. $(-\infty, -6)$

B. $(-6, 6)$

C. $\{6\}$

D. none

Answer: D

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MATRIX MATCH TYPE

1. Match the following for the equation $x^2 + a|x| + 1 = 0$ where, a is a parameter.

List I	List II
a. No real roots	**p.** $a<-2$
b. Two real roots	**q.** ϕ
c. Three real roots	**r.** $a=-2$
d. Four distinct real roots	**s.** $a\geq 0$

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2. Match the following for lists:

List I (Number of positive integers for which)	List II
a. one root is positive and the other is negative for the equation $(m-2)x^2-(8-2m)x-(8-3m)=0$	**p.** 0
b. exactly one root of equation $x^2-m(2x-8)-15=0$ lies in interval (0, 1)	**q.** infinite
c. the equation $x^2+2(m+1)x+9m-5=0$ has both roots negative	**r.** 1
d. the equation $x^2+2(m-1)x+m+5=0$ has both roots lying on either sides of 1	**s.** 2

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3. Match the following lists:

List I	List II
a. If $x^2+ax+b=0$ has roots α, β and $x^2+px+q=0$ has roots $-\alpha, \gamma$, then	**p.** $(1-bq)^2 = (a-pb)(p-aq)$
b. If $x^2+ax+b=0$ has roots α, β and $x^2+px+q=0$ has roots $1/\alpha, \gamma$, then	**q.** $(4-bq)^2 = (4a+2pb)(-2p-aq)$
c. If $x^2+ax+b=0$ has roots α, β and $x^2+px+q=0$ has roots $-2/\alpha, \gamma$, then	**r.** $(1-4bq)^2 = (a+2bp)(-2p-4aq)$
d. If $x^2+ax+b=0$ has roots α, β and $x^2+px+q=0$ has roots $-1/(2\alpha), \gamma$, then	**s.** $(q-b)^2 = (aq+bp)(-p-a)$

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4. Consider equation $\left(\left(x^2+x\right)^2\right)+a\left(x^2+x\right)+4=0$ Match the values of a in Lits II for the types of roods in Lits I.

A. $\begin{array}{ccccc} & a & b & c & d \\ (1) & p & q & r & s \end{array}$

B. $\begin{array}{ccccc} & a & b & c & d \\ (2) & q & r & r & p \end{array}$

C. $\begin{array}{ccccc} & a & b & c & d \\ (3) & r & p & s & q \end{array}$

D. $\begin{array}{ccccc} & a & b & c & d \\ (4) & q & s & p & r \end{array}$

Answer: 1

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5. If $ax^2 + bx + c = 0$ where $a \neq 0$ is satisfied by α, β, α^2 and β^2 where $\alpha\beta \neq 0$. Let set S be the set of all possible unordered pairs (α, β).

Then match the following lists:

List I	List II
a. The number of elements in set S is	p. 2
b. The sum of all possible values of $(\alpha + \beta)$ of the pair (α, β) in set S is	q. 3
c. The sum of all possible values of $\alpha\beta$ of the pair (α, β) in set S is	r. 4
d. The sum of all possible values of $\alpha^2 + \beta^2$ of the pair (α, β) in set S is, where $\alpha, \beta \in R$ is	s. 1

A. $\begin{array}{ccccc} & a & b & c & d \\ (1) & q & s & s & r \end{array}$

B. $\begin{array}{ccccc} & a & b & c & d \\ (2) & r & s & q & p \end{array}$

C. $\begin{array}{ccccc} & a & b & c & d \\ (3) & q & s & r & p \end{array}$

D. $\begin{array}{ccccc} & a & b & c & d \\ (4) & r & s & p & q \end{array}$

Answer: 1

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6. Consider equation $x^4 - 6x^3 + 8x^2 + 4ax - 4a^2 = 0, a \in R$. Then match the following lists:

List I	List II
a. If equation has four distinct roots then	p. $a \in \phi$
b. If equation has exactly two distinct roots then	q. $a \in (-1/2, 2)$
c. If equation has no real roots then	r. $a \in (-\infty, -1/2) \cup (2, \infty)$
d. If equation has four distinct positive roots then	s. $a \in (-\infty, 2)$

A. $\begin{array}{ccccc} & a & b & c & d \\ (1) & q & s & s & r \end{array}$

B. $\begin{array}{ccccc} & a & b & c & d \\ (2) & r & s & q & p \end{array}$

C. $\begin{array}{ccccc} & a & b & c & d \\ (3) & q & s & r & p \end{array}$

D. $\begin{array}{ccccc} & a & b & c & d \\ (4) & q & r & p & p \end{array}$

Answer: 4

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NUMERICAL VALUE TYPE

1. If $x = 2 + 2^{2/3} + 2^{1/3}$, then the value of $x^3 - 6x^2 + 6x$ is

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2. If $\sqrt{\sqrt{\sqrt{x}}} = x^4 + 4444,$ then the value of x^4 is___.

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3. Sum of the valus of x satisfying the equation $\sqrt{2x + \sqrt{2x + 4}} = 4$ is _____.

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4. If $a^2 - 4a + 1 = 4$, then the value of $\frac{a^3 - a^2 + a - 1}{a^2 - 1}(a^2 \neq 1)$

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5. If a and b are positive numbers and eah of the equations $x^2 + ax + 2b = 0$ and $x^2 + 2bx + a = 0$ has real roots, then the smallest possible value of $(a + b)$ is______.

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6. Given that $x^2 - 3x + 1 = 0$, then the value of the expression $y = x^9 + x^7 + x^{-9} + x^{-7}$ is divisible by prime number?

Watch Video Solution

7. If $\sin^2\alpha, \cos^2\alpha$ and $-\cos ec^2\alpha$ are the zeros of $P(x) = x^3 + x^2 + ax + b(a, b \in R)$. Then P(2) equals _____.

Watch Video Solution

8. If the equation $x^2-4x-(3k-1)|x-2|-2k+8=0, k \in R$, has exactly three distinct solutions, then k is equal to ____.

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9. Statement 1 : If $\cos^2\frac{\pi}{8}$ is a root of the equation $x^2+ax+b=0$, where $a, b \in \mathbb{Q}$, then ordered pair (a, b) is $\left[-1, \frac{1}{8}\right]$. Statement 2: If $a+mb=0$ and m is irrational, then $a, b=0$.

Watch Video Solution

10. Given $\alpha and \beta$ are the roots of the quadratic equation $x^2-4x+k=0(k \neq 0)\cdot$ If $\alpha\beta, \alpha\beta^2, \alpha^3+\beta^3$ are in geometric progression, then the value of $7k/2$ equals________.

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11. Let α_1, β_1 be the roots $x^2 - 6x + p = 0 and$ α_2, β_2 be the roots $x^2 - 54x + q = 0$. If $\alpha_1, \beta_1, \alpha_2, \beta_2$ form an increasing G.P., then sum of the digits of the value of $(q - p)$ is ________.

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12. Let $\alpha and \beta$ be the solutions of the quadratic equation $x^2 - 1154x + 1 = 0$, then the value of $\alpha^{\frac{1}{4}} + \beta^{\frac{1}{4}}$ is equal to _____.

Watch Video Solution

13. The quadratic equation $x^2 + mx + n = 0$ has roots which are twice those of $x^2 + px + m = 0 adm, n and p \neq 0$. The n the value of n/p is ____.

Watch Video Solution

14. Suppose a, b, c are the roots of the cubic $x^3 - x^2 - 2 = 0$. Then the value of $a^3 + b^3 + c^3$ is ____.

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15. Polynomial $P(x)$ is divided by $(x - 3)$, the remainder if 6.If $P(x)$ is divided by $(x^2 - 9)$, then the remainder is $g(x)$. Then the value of $g(2)$ is ________.

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16. If α and β are the roots of the equation $x^2 - 6x + 12 = 0$ and the value of $(\alpha - 2)^{24} - \frac{(\beta - 6)^8}{\alpha^8} + 1$ is 4^a, then the value of a is _____.

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17. Let $a and b$ be the roots of the equation $x^2 - 10cx - 11d = 0$ and those of $x^2 - 10ax - 11b = 0 are c, d then f \in d the value of$ a+b+c+d when a!=b!=c!=d

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18. Let $a, b \in R$ and $ab \neq 1$. If $6a^2 + 20a + 15 = 0$ and $15b^2 + 20b + 6 = 0$ then the value of $\frac{4030b^3}{ab^2 - 9(ab+1)^3}$ is ____.

View Text Solution

19. If there exists at least one real x which satisfies both the equatios $x^2 + 2x\sin y + 1 = 0$, where $y \in (0, \pi/2)$, and $ax^2 + x + 1 = 0$, then the value of $a + \sin y$ is ____.

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20. If the equation $x62 + 2(\lambda + 1)x + \lambda^2 + \lambda + 7 = 0$ has only negative roots, then the least value of λ equals________.

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21. All the values of k for which the quadratic polynomial $f(x) = 2x^2 + kx + k^2 + 5$ has two distinct zeroes and only one of them satisfying 0

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22. If set of values a for which $f(x) = ax^2 - (3 + 2a)x + 6a \neq 0$ is positive for exactly three distinct negative integral values of x is $(c, d]$, then the value of $\left(c^2 4 / d\right)$ is equal to ______.

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23. $a, b, and c$ are all different and non-zero real numbers on arithmetic progression. If the roots of quadratic equation $ax^2 + bx + c = 0 are \alpha and \beta$ such that $\frac{1}{\alpha} + \frac{1}{\beta}, \alpha + \beta, and \alpha^2 + \beta^2$ are in geometric progression the value of a/c will be____.

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24. Let $P(x) = \frac{5}{4} + 6x - 9x^2 and Q(y) = -4y^2 + 4y + \frac{13}{2}$. if there exists unique pair of real numbers (x, y) such that $P(x)Q(y) = 20$, then the value of $(6x + 10y)$ is ____.

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25. If equation $x^4 - (3m + 2)x^2 + m^2 = 0 (m > 0)$ has four real solutions which are in A.P., then the value of m is_____.

Watch Video Solution

26. If the equation $2x^2 + 4xy + 7y^2 - 12x - 2y + t = 0,$ where t is a parameter has exactly one real solution of the form (x, y) , then the sum of $(x + y)$ is equal to ____.

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27. Let $P\big(x0 = x^3 - 8x^2 + cx - d$ be a polynomial with real coefficients and with all it roots being distinct positive integers. Then number of possible value of c is________.

Watch Video Solution

28. Let $P(x) = x^4 + ax^3 + bx^2 + cx + d$ be a polynomial such that $P(1) = 1, P(2) = 8, P(3) = 27, P(4) = 64$ then the value of $152 - P(5)$ is________.

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29. Suppose $a, b, c \in I$ such that the greatest common divisor for $x^2 + ax + b$ and $x^2 + bx + c$ is $(x + 1)$ and the least common multiple of $x^2 + ax + b$ and $x^2 + bx + c$ is $\left(x^3 - 4x^2 + x + 6\right)$. Then the value of $|a + b + c|$ is equal to ________.

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30. Integral part of the product of non-real roots of equation $x^4 - 4x^3 + 6x^2 - 4x = 69$ is _____.

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31. If α, β and γ are roots of equation $x^3 - 3x^2 + 1 = 0$, then the value of $\left(\frac{\alpha}{1+\alpha}\right)^3 + \left(\frac{\beta}{1+\beta}\right)^3 + \left(\frac{\gamma}{1+\gamma}\right)^3$ is _______.

Watch Video Solution

32. If the roots of the cubic, $x^3 + ax^2 + bx + c = 0$ are three consecutive positive integers, then the value of $\frac{a^2}{b+1}$ is equal to ________.

Watch Video Solution

33. The function k$f(x) = ax^3 + bx^2 + cx + d$ has three positive roots. If the sum of the roots of $f(x)$ is 4, the larget possible inegal values of c/a is ________.

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34. If $b^2 - 4ac \leq 0$ ("where" $a \neq 0$ and $a, b, c, x, y \in R$) satisfies the system $ax^2 + x(b-3) + c + y = 0$ and $ay^2 + y(b-1) + c + 3x = 0$, then value of $\frac{x}{y}$ is ________.

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35. If $\left(a^2-14a+13\right)x^2+(a+2)x-2=0$ does not have two distinct real roots, then the maximum value of a^2-15a is _______.

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36. Let $px^2+qx+r=0$ be a quadratic equation $(p, q, r \in R)$ such that its roots are α and β. If $p+q+r<0, p-q+r<0$ and $r>0$, then the value of $[\alpha]+[\beta]$ is (where[x] denotes the greatest integer x)______.

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37. Let $x^2+y^2+xy+1 \geq a(x+y)\,\forall x, y \in R,$ then the number of possible integer (s) in the range of a is________.

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38. function f , R $\rightarrow$ R , $f(x)=\dfrac{3x^2+mx+n}{x^2+1}$, if the range of function is [-4,3), find the value of |m+n| is ....

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39. If a, b, c are non-zero real numbers, then find the minimum value of the expression $\left(\frac{(a^4+3a^2+1)(b^4+5b^2+1)(c^4+7c^2+1)}{a^2b^2c^2}\right)$ which is not divisible by prime number.

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40. If $a, b, \in R$ such that $a+b=1 and (1-2ab0(a63+b^3)=12$. The value of (a^2+b^2) is equal to____.

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41. If the cubic $2x^3-9x^2+12x+k=0$ has two equal roots then minimum value of $|k|$ is_____.

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42. Let $a, b, andc$ be distinct nonzero real numbers such that $\frac{1-a^3}{a} = \frac{1-b^3}{b} = \frac{1-c^3}{.}$ The value of $\left(a^3+b3+c^3\right)$ is __________.

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43. Evaluate :

(i) i^{135}

(ii) i^{-47}

(iii) $\left(-\sqrt{-1}\right)^{4n+3}, n \in N$

(iv) $\sqrt{-25} + 3\sqrt{-4} + 2\sqrt{-9}$

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Archives JEE MAIN (single correct Answer Type)

1. If the roots of the equation $bx^2 + cx + a = 0$ be imaginary, then for all real values of x, the expression $3b^2x^2 + 6bcx + 2c^2$ is (1) greater than 4ab (2) less than 4ab (3) greater than $-4ab$ (4) less than $4ab$

A. greater than 4ab.

B. less then 4ab

C. grreater than - 4ab.

D. less than - 4ab.

Answer: 3

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2. Show that the equation $e^{\sin x} - e^{-\sin x} - 4 = 0$ has no real solution.

A. infinite number of real roots

B. no real roots

C. exactly one real root

D. exactly four real roots

Answer: 2

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3. If a, b, c are positive real numbers such that the equations $ax^2 + bx + c = 0$ and $bx^2 + cx + a = 0$, have a common root, then

A. $1:2:3$

B. $3:2:1$

C. $1:3:2$

D. $3:1:2$

Answer: 1

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4. Let α and β be the roots of equation $px^2 + qx + r = 0, p \neq 0$.If p, q, r are in A.P. and $\frac{1}{\alpha} + \frac{1}{\beta} = 4$, then the value of $|\alpha - \beta|$ is :

A. $\frac{\sqrt{61}}{9}$

B. $\frac{2\sqrt{17}}{9}$

C. $\frac{\sqrt{34}}{9}$

D. $\frac{2\sqrt{13}}{9}$

Answer: 4

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5. The sum of all real values of X satisfying the equation $\left(x^2 - 5x + 5\right)^{x^2 + 4x - 60} = 1$ is:

A. -4

B. 6

C. 5

D. 3

Answer: 4

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6. If, for a positive integer n, the quadratic equation, $x(x+1)+(x-1)(x+2)+\ +(x+n-1)(x+n)=10n$ has two consecutive integral solutions, then n is equal to : $(1)10$ **(2)** 11 **(3)** 12 **(4)** 9

A. 11

B. 12

C. 9

D. 10

Answer: 1

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7. Let $S=\{x\in R: x\geq 0 \text{ and } 2\mid(\sqrt{x}-3\mid+\sqrt{x}(\sqrt{x}-6)+6=0\}$ then S (1) is an empty set (2) contains exactly one element (3) contains exact;y two elements (4) contains exactly four elements

A. contains exactly four elements

B. is an empty set

C. contains exactly one element

D. contains exactly two elements

Answer: 4

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JEE ADVANCED (Single Correct Type)

1. Q. Let p and q real number such that $p \neq 0, p^2 \neq q$ and $p^2 \neq -q$. if α and β are non-zero complex number satisfying $\alpha+\beta=-p$ and $\alpha^3+\beta^3=q$, then a quadratic equation having $\frac{\alpha}{\beta}$ and $\frac{\beta}{\alpha}$ as its roots is

A. $(p^3+q)x^2-(p^3+2p)x+(p^3+q)=0$

B. $(p^3+q)x^2-(p^3-2p)x+(p^3+q)=0$

C. $(p^3-q)x^2-(5p^3-2p)x+(p^3-q)=0$

D. $(p^3-q)x^2-(5p^3+2p)x+(p^3-q)=0$

Answer: 2

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2. The value of b for which the equation $x^2 + bx - 1 = 0$ and $x^2 + x + b = 0$ have one root in common is (a) $-\sqrt{2}$ (b) $-i\sqrt{3}$ (c) $i\sqrt{5}$ (d) $\sqrt{2}$

A. $-\sqrt{2}$

B. $-i\sqrt{3}$

C. $\sqrt{2}$

D. $\sqrt{3}$

Answer: B

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3. Let α and β be the roots of $x^2 - 6x - 2 = 0$ with $\alpha > \beta$ if $a_n = \alpha^n - \beta^n$ for $n \geq 1$ then the value of $\frac{a_{10} - 2a_8}{2a_9}$

A. 1

B. 2

C. 3

D. 4

Answer: C

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4. The quadratic equation $p(x) = 0$ with real coefficients has purely imaginary roots. Then the equation $p(p(x)) = 0$ has only purely imaginary roots at real roots two real and purely imaginary roots neither real nor purely imaginary roots

A. only purely imaginary roots

B. all real roots

C. two real and two purely imaginary roots

D. neither real nor purealy imaginary roots

Answer: 3

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5. Let $-\frac{\pi}{6} < \theta < -\frac{\pi}{12}$. Suppose α_1 and β_1, are the roots of the equation $x^2 - 2x\sec\theta + 1 = 0$ and α_2 and β_2 are the roots of the equation $x^2 + 2x\tan\theta - 1 = 0$. If $\alpha_1 > \beta_1$ and $\alpha_2 > \beta_2$, then $\alpha_1 + \beta_2$ equals:

A. $2(\sec\theta - \tan\theta)$

B. $2\sec\theta$

C. $-2\tan\theta$

D. 0

Answer: 4

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JEE ADVANCED (Multiple Correct Answer Type)

1. Let S be the set of all non-zero real numbers such that the quadratic equation $\alpha x^2 - x + \alpha = 0$ has two distinct real roots $x_1 and x_2$ satisfying the inequality $|x_1 - x_2| < 1$. Which of the following intervals is (are) a subset (s) of S? $\left(\frac{1}{2}, \frac{1}{\sqrt{5}}\right)$ b. $\left(\frac{1}{\sqrt{5}}, 0\right)$ c. $\left(0, \frac{1}{\sqrt{5}}\right)$ d. $\left(\frac{1}{\sqrt{5}}, \frac{1}{2}\right)$

A. $\left(-\frac{1}{2}, -\frac{1}{\sqrt{5}}\right)$

B. $\left(-\frac{1}{\sqrt{5}}, 0\right)$

C. $\left(0, \frac{1}{\sqrt{5}}\right)$

D. $\left(\frac{1}{\sqrt{5}}, \frac{1}{2}\right)$

Answer: 1,4

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JEE ADVANCED (Multiple Correct Answer Type)

1. Let p, q be integers and let α, β be the roots of the equation, $x^2 - x - 1 = 0,$ where $\alpha \neq \beta$. For $n = 0, 1, 2, , let a_n = p\alpha^n + q\beta^n.$ FACT : If $a and b$ are rational number and $a + b\sqrt{5} = 0, then a = 0 = b.$. Then a_{12} is

A. $a_{11} - a_{10}$

B. $a_{11} + a_{10}$

C. $2a_{11} + a_{10}$

D. $a_{11} + 2a_{10}$

Answer: 2

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2. Let p, q be integers and let α, β be the roots of the equation, $x^2 - x - 1 = 0$, where $\alpha \ne \beta$. For $n = 0, 1, 2, , let a_n = p\alpha^n + q\beta^n$. FACT : If $a and b$ are rational number and $a + b\sqrt{5} = 0, then a = 0 = b$. If $a_4 = 28, then p + 2q =$ 7 (b) 21 (c) 14 (d) 12

A. 21

B. 14

C. 7

D. 12

Answer: 4

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JEE ADVANCED (Numerical Value Type)

1. The number of distinct real roots of $x^4 - 4x^3 + 12x^2 + x - 1 = 0 is\_ \_\_ \_\_ .$

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