QEE

1. The equation whose roots are opposite in sign to those of the equation $x^2 - 3x - 4 = 0$ is given by
(A) $4x^2 - 3x + 1 = 0$ (B) $x^2 + 3x - 4 = 0$
(C) $x^2 + 3x + 4 = 0$ (D) none of these

2. Sum of the roots of the equation $x^5 - 5x^3 + x + 1 = 0$ is given by
(A) 0 (B) 5
(C) – 1 (D) none of these

3. If the roots of quadratic equation $ax^2 + bx + c = 0$ are equal in magnitude and opposite in sign then
(A) $a = 0$ (B) $c = 0$
(C) $a = c$ (D) none of these

4. One of the roots of the quadratic equation $(\sin^2 \theta)\, x^2 - x + \cos^2 \theta = 0$ is given by
(A) – 1 (B) 2
(C) 1 (D) none of these

5. If α and β are the roots of $ax^2 + bx + c = 0$, then the equation whose roots are $\frac{1}{\alpha}$ and $\frac{1}{\beta}$ is given by
(A) $ax^2 + cx + b = 0$ (B) $cx^2 + bx + a = 0$
(C) $(ac - b^2)\, x^2 + bx + c = 0$ (D) none of these

6. If $\frac{1}{x-2} \geq \frac{1}{3}$; then x belongs to
(A) $(-\infty, 5]$ (B) $[2, 5]$
(C) $(2, 5]$ (D) none of these

7. The number of real roots of the equation $2^{2x^2-7x+5} = 1$ is
(A) 0 (B) 1
(C) 2 (D) 4

8. The real roots of the equation $7^{\log_7\left(x^2-4x+5\right)} = (x - 1)$ are
(A) 1 and 2 (B) 2 and 3
(C) 3 and 4 (D) 4 and 5

9. If roots of quadratic equation $ax^2 + 2bx + c = 0$ are not real, then $ax^2 + 2bxy + cy^2 + dx + ey + f = 0$ represent
(A) Ellipse (B) Circle
(C) Parabola (D) Hyperbola

10. $3x^{10} - 5x^2 + 7 = 0$ is an
(A) equation (B) expression
(C) identity (D) none of these

11. Expression $x^2 + px + q$ will be a perfect square of linear expression if
(A) $p^2 - 4q = 0$ (B) $p^2 + 4q = 0$
(C) $q^2 = p^2$ (D) none of these

12. If a, b, c are the roots of the equation $x^3 - px^2 + qx - r = 0$ then the value of $\frac{1}{a^2}+\frac{1}{b^2}+\frac{1}{c^2}$ is

(A) $\frac{q^2 + 2pr}{r}$ (B) $\frac{q^2 - 2pr}{r}$
(C) $\frac{q^2 + 2pr}{r^2}$ (D) $\frac{q^2 - 2pr}{r^2}$

13. If a, b, c $\in$R, the roots of a equation $(x - a)(x - b) + (x - b)(x - c) + (x - c)(x - a) = 0$ are
(A) rational (B) irrational
(C) imaginary (D) real

14. Root of equation $3^{x-1} + 3^{1-x} = 2$ is
(A) 2 (B) 3
(C) 4 (D) none of these

15. If $(1 + m)x^2 - 2(1 + 3m)x + (1 + 8m) = 0$ has equal roots, then m is equal to
(A) 0, 1 (B) 0, 2
(C) 0, 3 (D) none of these

16. If the roots of the equation $(a^2 + b^2) x^2 + 2x (ac + bd) + c^2 + d^2 = 0$ are real, then
(A) ad = bc (B) ab = cd
(C) ac = bd (D) none of these

17. If r be the ratio of the roots of the equation $ax^2 + bx + c = 0$, then $\frac{(r+1)^2}{r}$ is equal to
(A) $\frac{a^2}{bc}$ (B) $\frac{b^2}{ac}$
(C) $\frac{c^2}{ab}$ (D) none of these

18. If the roots of the equation $x^2 + px + q = 0$ differ from the roots of the equation $x^2 + qx + p = 0$ by the same quantity, then p + q is equal to
(A) −1 (B) −2
(C) −3 (D) −4

19. The quadratic equation whose one of the roots is $\frac{1}{2+\sqrt{5}}$ is
(A) $x^2 + 4x - 1 = 0$ (B) $x^2 + 3x - 1 = 0$
(C) $x^2 + 4x + 1 = 0$ (D) none of these

20. Let α, β be the roots of $x^2 - x + p = 0$ and γ, δ be the roots of $x^2 - 4x + q = 0$. If $\alpha, \beta, \gamma, \delta$ are in G.P. , then the integral value of p and q respectively are
(A) −2, −32 (B) −2, 3
(C) −6, 3 (D) −6, −32

21. If α, β are roots of $x^2 - p(x + 1) - c = 0$ then $(\alpha + 1) (\beta + 1)$ is equal to
(A) c (B) c − 1
(C) 1 − c (D) none of these

22. For $a \neq b$, if the equations $x^2 + ax + b = 0$ and $x^2 + bx + a = 0$ have a common root, then the value of (a + b) is
(A) −1 (B) 0
(B) 1 (D) 2

23. If the roots of the equation $\frac{x^2 - bx}{ax - c} = \frac{\lambda - 1}{\lambda + 1}$ are equal and opposite then the value of λ is

(A) $\frac{a-b}{a+b}$ (B) c

(C) $\frac{1}{c}$ (D) $\frac{a+b}{a-b}$

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

(A) no solution (B) one solution

(C) two solution (D) none of these

25. If α, β are the roots of the equation $ax^2 + 3x + 2 = 0$, then the sign of expression $\frac{\alpha^2}{\beta} + \frac{\beta^2}{\alpha}$ is

(A) positive (B) negative

(C) can't say (D) none of these

26. If α and β be the roots of the equation $ax^2 + bx + c = 0$, then $a\left(\frac{\alpha^2}{\beta} + \frac{\beta^2}{\alpha}\right) + b\left(\frac{\alpha}{\beta} + \frac{\beta}{\alpha}\right)$ is equal to

(A) a (B) b

(C) c (D) none of these

27. If $(a^2 - 1)x^2 + (a - 1)x + a^2 - 4a + 3 = 0$ be an identity in x. Then value of a is

(A) 1 (B) 2

(C) 3 (D) none of these

28. If $3^{x+1} = 6^{\log_2 3}$, then x is

(A) 3 (B) 2

(C) $\log_3 2$ (D) $\log_2 3$

29. If α and β are the roots of $2x^2 - 5x + 7 = 0$, then equation whose roots are $2\alpha + 3\beta$, $3\alpha + 2\beta$ is

(A) $x^2 - 25x + 82 = 0$ (B) $2x^2 - 25x + 82 = 0$

(C) $x^2 - 20x + 64 = 0$ (D) none of these

30. The set of all the possible values of a, so that 6 lies between the roots of the equation $x^2 + 2(a - 3)x + 9 = 0$ is

(A) $(-\infty, 0) \cup (6, 0)$ (B) $(-\infty, -3/4)$

(C) $(0, \infty)$ (D) none of these

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

(A) 0 (B) 2

(C) 1 (D) 3

32. $\forall x \in Z$, the number of values of x for which $x^2 - 5x + 6 \le 0$ and $x^2 - 2x > 0$ is

(A) 1 (B) 2

(C) 3 (D) 4

33. If α, β are the roots of the equation $x^2 - px + q = 0$ then product of the roots of the quadratic equation whose roots are $\alpha^2 - \beta^2$, $\alpha^3 - \beta^3$ is

(A) $p(p^2 - q)^2$ (B) $p(p^2 - q)(p^2 - 4q)$

(C) $p(p^2 - 4q)(p^2 + q)$ (D) none of these

34. If $x \in [2, 4]$ then for the expression $x^2 - 6x + 5$
(A) the least value = -4 (B) the greatest value = 4
(C) the least value = 3 (D) the greatest value = -3

35. The value of x for which $\frac{(x-1)(x+2)^4}{(x+1)^3(x-3)^2} \le 0$ is
(A) $[-1, 1]$ (B) $(-1, 1]$
(C) $(-1, 1)$ (D) none of these

36. If a and b are non–zero roots of the equation $x^2 + ax + b = 0$ then the least value of $x^2 + ax + b = 0$ is
(A) 0 (B) – 9/4
(C) 9/4 (D) none of these

37. $(x - 3)^2(x + 2) \ge 0$ for all values of x belonging to interval
(A) $[-2, \infty)$ (B) $(-\infty, -2]$
(C) $[-2, 3)$ (D) none of these

38. The roots of quadratic equation are always rational if and only if
(A) D is a perfect square
(B) D is a perfect square and coefficients are rational
(C) D is not a perfect square
(D) D is not a perfect square and coefficients irrational

39. The graph of quadratic equation expression $f(x) = ax^2 + bx + c$ with $a > 0$ is always above x-axis iff
(A) D = 0 (B) D > 0
(C) D < 0 (D) none of these

40. Quadratic equations $(a - b)x^2 + (b - c)x + (c - a) = 0$ and
$(2a - b - c)x^2 + (2b - c - a)x + (2c - a - b) = 0$ have a common root, given by
(A) a (B) c
(C) b (D) 1

41. If one of the root of a quadratic equation with rational coefficients is rational, then other root must be
(A) imaginary (B) irrational
(C) rational (D) none of these

42. If two roots of quadratic equation $ax^2 + bx + c = 0$ are α, β, then the roots of the quadratic equation $ax^2 - bx + c = 0$ are given by
(A) $\frac{1}{\alpha}, \frac{1}{\beta}$ (B) $-\alpha, -\beta$
(C) $\frac{1}{\alpha^2}, \frac{1}{\beta^2}$ (D) none of these

43. In the quadratic equation $(2a - 3)x^2 + ax + a - 5 = 0$, the value of a can never be
(A) 3/2 (B) 0
(C) 5 (D) none of these

44. The quadratic equation whose roots are –2 and 4 is given by
(A) $x^2 - 2x - 8 = 0$ (B) $x^2 - 2x + 8 = 0$
(C) $x^2 + 2x + 8 = 0$ (D) none of these

45. If p, q be two positive numbers, then the number of real roots of quadratic equation $px^2 + q|x| + 5 = 0$ is

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

46. If p and q are roots of the quadratic equation $x^2 + mx + m^2 + a = 0$, then the value of $p^2 + q^2 + pq$ is

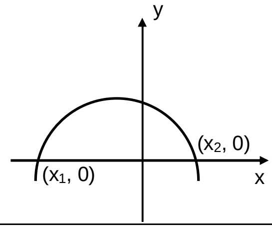
(A) 0 (B) a
(C) –a (D) $\pm m^2$

47. The number of real roots of the equation $|x|^2 - 3|x| + 2 = 0$ is

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

48. The diagram shows the graph of $y = ax^2 + bx + c$, then

(A) $a > 0$
(B) $b < 0$
(C) $c > 0$
(D) $b^2 - 4ac = 0$



49. The equation whose roots are 1 and 0, is

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

50. One root of $px^2 - 14x + 8 = 0$ is six times the other then p is

(A) 0 (B) 3
(C) 1/3 (D) 1

51. Roots of the equation $(x - a)(x - b) = h^2$ are

(A) real and equal (B) real and unequal
(C) imaginary (D) none of these

52. If $x^{1/2} + x^{1/4} = 12$, then x is

(A) 16 or 81 (B) 81 or 256
(C) 81 (D) 16 or 256

53. One root of a quadratic equation is $2 + \sqrt{3}$, then product of roots will be

(A) 7 (B) 4
(C) 0 (D) 1

54. The expression $-x^2 + 3x + 9$ is always

(A) positive (B) negative
(C) 0 (D) none of these

55. If $3x^2 - 2mx - 4 = 0$ and $x^2 - 4m + 2 = 0$ have a common root, then m is

(A) $\pm \frac{1}{2}$ (B) $\pm \frac{1}{\sqrt{3}}$

(C) $\pm \frac{1}{3}$ (D) $\pm \frac{1}{\sqrt{2}}$

56. Set of values of x which satisfies $\frac{(x^2-4)(x-2)}{(x-1)(x-6)} \ge 0$, is

(A) $(-2, 1) \cup (6, \infty)$ (B) $[-2, 1) \cup (6, \infty)$
(C) $(-\infty, -2] \cup (6, \infty)$ (D) $[-2, 1) \cup (1, 6)$

57. If α and β are the roots of the equation $ax^2 + bx + c = 0$, then $(a \neq 0)$

(A) $a(\alpha + \beta) + c = 0$ (B) $a(\alpha + \beta) + b = 0$
(C) $a + \alpha + \beta = 0$ (D) $b(\alpha + \beta) + a = 0$

58. If the product of the roots of the equation $x^2 - 5x + 4^{\log_2 \lambda} = 0$ is 8, then λ is

(A) $2\sqrt{2}$ (B) $\pm 2\sqrt{2}$
(C) 3 (D) none of these

59. The set of values of 'a' for which 1 lies between the roots of the equation $x^2 + ax + 4 = 0$, is

(A) $(-\infty, -5)$ (B) $(4, \infty)$
(C) $(5, \infty)$ (D) $(-5, 4)$

60. If $ax^2 + bx + c < 0$, $x \in R$ then $ax^2 + bx + c = 0$ has $(a \neq 0)$

(A) two real roots (B) one real root
(C) complex roots (D) none of these

61. If $x^2 + ax + b = 0$ and $x^2 + bx + a = 0$ have a common root α, $(a \neq b)$ then

(A) $a + b + 1 = 0$ (B) $a + b = 1$
(C) $\alpha + 1 = 0$ (D) none of these

62. The set of values of p for which the roots of the equation $3x^2 + 2x + p(p-1) = 0$ are of the opposite sign is

(A) $(-\infty, 0)$ (B) $(0, 1)$ (C) $(1, \infty)$ (D) $(0, \infty)$

63. If the roots of the equation $x^2 - px + q = 0$ differ by unity, then

(A) $p^2 = 1 - 4q$ (B) $p^2 = 1 + 4q$ (C) $q^2 = 1 - 4p$ (D) $q^2 = 1 + 4p$

64. If $y = 2[x] + 3 = 3[x - 2] + 5$, then $[x + y]$ is ([x] denotes the greatest integer function)

(A) 10 (B) 15
(C) 12 (D) none of these

65. The set of solutions of $\frac{(x-1)^3(x+2)^2}{(e^x-1)x^3} \ge 0$ is

(A) $(1, \infty)$ (B) $(-2, 1)$
(C) $(-\infty, -2) \cup [1, \infty)$ (D) none of these

66. If the roots of $x^2 + (a-2)x + a^2 = 0$ are equal in magnitude but opposite in signs, then

(A) $a \in \left(\frac{-1-\sqrt{13}}{3}, \frac{-1+\sqrt{13}}{3}\right)$ (B) $a \in \left(\frac{-1-\sqrt{13}}{3}, \infty\right)$
(C) $a \in \left(\frac{-1+\sqrt{13}}{3}, \infty\right)$ (D) none of these

67. Total number of real roots of $\sin x = x^2 + x + 1$ is /are to ;

(A) 1 (B) 2
(C) 3 (D) none of these

68. The equation $\sin^2 x - 2\sin x + a = 0$ will have atleast one real root if,
(A) $a \in [-3, 1]$ (B) $a \in [-1, 1]$
(C) $a \in [0, 1]$ (D) none of these

69. The number of real solutions of the equation $(x-1)^2 - 4|x-1| + 3 = 0$ is
(A) 4 (B) 2
(C) 1 (D) 3

70. If the equations $ax^2 + bx + c = 0$ and $cx^2 + bx + a = 0$ $a \neq c$ have negative common root then the value of $a - b + c$ is
(A) 0 (B) 2
(C) 1 (D) none of these

71. The number of integral solutions of $\frac{x+2}{x^2+1} > \frac{1}{2}$ is
(A) 4 (B) 5
(C) 3 (D) none of these

72. If $ax^2 + bx + 9 = 0$ does not have distinct real roots. $a, b \in R$, then the greatest value of $b - 3a$ is
(A) 3 (B) –3
(C) 6 (D) –6

73. If $x^2 - 3x + 2$ is a factor of $x^4 - px^2 + q = 0$ then p, q are
(A) 2, 3 (B) 4, 5
(C) 5, 4 (D) 0, 0

74. The inequality $|2x - 3| < 1$ is valid when x lies in the interval
(A) (3, 4) (B) (1, 2)
(C) (–1, 2) (D) (–4, 3)

75. If $\sin\alpha$ and $\cos\alpha$ are the roots of the equation $lx^2 + mx + n = 0$, then
(A) $l^2 - m^2 + 2ln = 0$ (B) $l^2 + m^2 + ln = 0$
(C) $l^2 - m^2 - ln = 0$ (D) $l^2 + m^2 - ln = 0$

76. If $\frac{x-2}{x+2} > \frac{2x-3}{4x-1}$ then values of x are
(A) $(-\infty, -2) \cup \left(\frac{1}{4}, 1\right) \cup (4, \infty)$ (B) $\left(-2, \frac{1}{4}\right) \cup (1, 4)$
(C) $\left(\frac{1}{2}, 1\right)$ (D) none of these

77. If roots of the equation $9x^2 + 4ax + 4 = 0$ are imaginary, then
(A) $a \in (-3, 3)$ (B) $a \in (-\infty, -3) \cup (3, \infty)$
(C) $a \in (2, 3)$ (D) none of these

78. If $(\lambda^2 + \lambda - 2)x^2 + (\lambda + 2)x < 1$ for all $x \in R$ then λ belongs to the interval
(A) (–2, 1) (B) (–2, 2/5) (C) (2/5, 1) (D) none of these

79. If α, β, γ be the roots of the equation $x(1 + x^2) + x^2(6 + x) + 2 = 0$. Then the value of $\alpha^{-1} + \beta^{-1} + \gamma^{-1}$ is
(A) –3 (B) 1/2 (C) –1/2 (D) none of these

80. If the roots of $4x^2 + 5k = (5k+1)x$ differ by unity then the negative value of k is

(A) –3 (B) –1/5 (C) –3/5 (D) none of these

81. The solution set of the inequation $\log_{1/3}(x^2 + x+1) + 1 > 0$ is
(A) $(-\infty, -2) \cup (1, \infty)$ (B) $[-1, 2]$
(C) $(-2, 1)$ (D) $(-\infty, \infty)$

82. Let α and β are the roots of equation $x^2 + x + 1 = 0$, the equation whose roots are α^{19}, β^{17} is
(A) $x^2 - x - 1 = 0$ (B) $x^2 - x + 1 = 0$ (D) $x^2 + x - 1 = 0$ (D) $x^2 + x + 1 = 0$

83. If p and q are non–zero constants, the equation $x^2 + px + q = 0$ has roots α and β, the equation $qx^2 + px + 1 = 0$ has roots
(A) α and $1/\beta$ (B) $1/\alpha$ and β (C) $1/\alpha$ and $1/\beta$ (D) none

84. The solution set of $\frac{x^2 - 3x + 4}{x + 1} > 1$, $x \in R$, is
(A) $(3, \infty)$ (B) $(-1, 1) \cup (3, \infty)$ (C) $[-1, 1] \cup [3, \infty)$ (D) none

85. If the quadratic equation $\alpha x^2 + \beta x + a^2 + b^2 + c^2 - ab - bc - ca = 0$ has imaginary roots, then
(A) $2(\alpha - \beta) + (a - b)^2 + (b - c)^2 + (c - a)^2 > 0$
(B) $2(\alpha - \beta) + (a - b)^2 + (b - c)^2 + (c - a)^2 < 0$
(C) $2(\alpha - \beta) + (a - b)^2 + (b - c)^2 + (c - a)^2 = 0$
(D) none of these .

87. If $x^2 + ax + b$ is an integer for every integer x then
(A) ‘a’ is always an integer but ‘b’ need not be an integer
(B) ‘b’ is always an integer but ‘a’ need need not be an integer
(C) a+b is always an integer
(D) a and b are always integers.

88. The value of ‘p’ for which the sum of the square of the roots of $2x^2 - 2(p - 2)x - p - 1 = 0$ is least, is
(A) 1 (B) 11/4 (C) 2 (D) –1

89. If $x^2 - 4x + \log_{\frac{1}{2}} a = 0$ does not have two distinct real roots, then maximum value of a is
(A) $\frac{1}{4}$ (B) $\frac{1}{16}$
(C) $-\frac{1}{4}$ (D) none of these

90. The largest negative integer which satisfies $\frac{x^2 - 1}{(x - 2)(x - 3)} > 0$ is
(A) –4 (B) –3
(C) –1 (D) –2

91. The number of real solutions of $x - \frac{1}{x^2 - 4} = 2 - \frac{1}{x^2 - 4}$ is
(A) 0 (B) 1
(C) 2 (D) infinite

92. If the roots of $4x^2 + 5k = (5k + 1)x$ differ by unity then the negative value of k is

(A) -3 (B) $-\frac{1}{5}$

(C) $-\frac{3}{5}$ (D) none of these

93. If the absolute value of the difference of roots of the equation $x^2 + px + 1 = 0$ exceeds $\sqrt{3}p$ then

(A) $p < -1$ or $p > 4$ (B) $p > 4$

(C) $-1 < p < 4$ (D) $0 \le p < 4$

94. If a, b, c, d are positive reals such that $a + b + c + d = 2$ and $m = (a + b)(c + d)$, then

(A) $0 \le m \le 1$ (B) $1 \le m \le 2$

(C) $2 \le m \le 3$ (D) $3 \le m \le 4$

95. If $\frac{a^n + b^n}{a^{n-1} + b^{n-1}}$ be the geometric mean between two distinct positive reals a and b, then the value of n is

(A) 0 (B) 1/2

(C) –1/2 (D) 1

96. Consider an infinite geometric series with first term a and common ratio r. If its sum is 4 and the second term is 3/4, then

(A) $a = 7/4$, $r = 3/7$ (B) $a = 2$, $r = 3/8$

(C) $a = 3/2$, $r = 1/2$ (D) $a = 3$, $r = 1/4$

97. If $a + b + c = 0$ then $x^{a^2/bc} . x^{b^2/ca} . x^{c^2/ab}$ is equal to ……..

98. If $ax^2 + bx + c = 0$ and $bx^2 + cx + a = 0$ have a common root and $a \ne 0$, then $\frac{a^3 + b^3 + c^3}{abc}$ is equal to ………..

99. If a, b, c are positive real numbers, then the number of real roots of the equation $ax^2 + b|x| + c = 0$ is …………..

100. The solution set of $\frac{x^2 - 3x + 4}{x + 1} > 1$, $x \in R$, is

(A) $(3, \infty)$ (B) $(-1, 1) \cup (3, \infty)$

(C) $[-1, 1] \cup [3, \infty)$ (D) none of these

LEVEL−II

1. A quadratic equation whose roots are $\sec^2\alpha$ and $\text{cosec}^2\alpha$ can be;
(A) $x^2 - 2x + 2 = 0$
(B) $x^2 - 3x + 3 = 0$
(C) $x^2 - 4x + 4 = 0$
(D) none of these

2. If x_1, x_2 are roots of $x^2 - 3x + a = 0$, $a \in R$ and $x_1 < 1 < x_2$ then;
(A) $a \in (-\infty, 2)$
(B) $\left(-\infty, \dfrac{9}{4}\right]$
(C) $\left(2, \dfrac{9}{4}\right]$
(D) none of these

3. If the sum of the roots of the quadratic equation $ax^2 + bx + c = 0$ is equal to sum of the squares of the reciprocals then $\dfrac{b^2}{ac} + \dfrac{bc}{a^2}$ is equal to;
(A) 2
(B) –2
(C) 1
(D) –1

4. If discriminant of a quadratic equation $ax^2 + bx + c = 0$ is a perfect square then roots are always
(A) rational
(B) integers
(C) imaginary
(D) none of these

5. The values of 'a' for which the quadratic expression $x^2 - ax + 4$ is non–negative for all real values of x; is given by
(A) $(-4, 4)$
(B) $[-4, 4]$
(C) $(-\infty, -4) \cup (4, \infty)$
(D) none of these

6. If a, b, c are odd integers, then roots of the quadratic equation $ax^2 + bx + c = 0$
(A) are always rational
(B) cannot be rational
(C) are imaginary
(D) none of these

7. If x be real, then maximum value of the expression $7 + 10x - 5x^2$ is given by
(A) 7
(B) 10
(C) 12
(D) none of these

8. The number of solutions of $\dfrac{\log 5 + \log(x^2 + 1)}{\log(x - 2)} = 2$ is
(A) 2
(B) 3
(C) 1
(D) none of these

9. The roots of the equation $(a + c - b)x^2 - 2cx + (b + c - a) = 0$ are
(A) 1, $\dfrac{2c}{a + c - b}$
(B) 1, $\dfrac{b + c - a}{a + c - b}$
(C) 1, $\dfrac{b + c - a}{2c}$
(D) 1, $\dfrac{a + c - b}{b + c - a}$

10. If the product of the roots of the equation $x^2 - 3kx + 2e^{2\log k} - 1 = 0$ is 7, then the roots are real for k equal to
(A) 2
(B) 4
(C) −2
(D) none of these

11. If $\sin\theta$ and $\cos\theta$ are the roots of the equation $ax^2 + bx + c = 0$, then

(A) $(a - c)^2 = b^2 - c^2$ (B) $(a - c)^2 = b^2 + c^2$
(C) $(a + c)^2 = b^2 - c^2$ (D) $(a + c)^2 = b^2 + c^2$

12. If the roots of $x^2 + ax + b = 0$ are non−real, then the value of $a^2 - 4b - 1$ is always
(A) negative (B) positive
(C) zero (D) nothing can be said

13. If α, β are the roots of the equation $ax^2 + bx + c = 0$, then the roots of the equation $cx^2 + bx + a = 0$, are
(A) $-\alpha, -\beta$ (B) $\alpha, -\beta$
(C) $\alpha, \frac{1}{\beta}$ (D) $\frac{1}{\alpha}, \frac{1}{\beta}$

14. If $ax^2 + bx + c = 0$ is satisfied by every value of x, then
(A) $b = 0, c = 0$ (B) $c = 0$
(C) $b = 0$ (D) $a = b = c = 0$

15. Let S be the set of values of 'a' for which 2 lie between the roots of quadratic equation $x^2 + (a + 2)x - (a + 3) = 0$. Then S is given by
(A) $(-\infty, -5)$ (B) $(5, \infty)$
(C) $(-\infty, -5]$ (D) $[5, \infty)$

16. If α, β, γ are the roots of the equation, $x^3 + P_0x^2 + P_1x + P_2 = 0$, then $(1 - \alpha^2)(1 - \beta^2)(1 - \gamma^2)$ is equal to
(A) $(1 + P_1)^2 - (P_0 + P_2)^2$ (B) $(1 + P_1)^2 + (P_0 + P_2)^2$
(C) $(1 - P_1)^2 - (P_0 - P_2)^2$ (D) None of these

17. The set of values of 'a' for which the inequality $x^2 - (a + 2)x - (a + 3) < 0$ is satisfied for at least one positive real x is _________.

18. Consider the equation $x^3 - nx + 1 = 0$, $n \in N$, $n \geq 3$. Then
(A) Equation has atleast one rational root .
(B) Equation has exactly one rational root.
(C) Equation has atleast one root belonging to (0, 1).
(D) Equation has no rational root.

19. The real values of x which satisfy $x^2 - 3x + 2 \geq 0$ and $x^2 - 3x - 4 \leq 0$ are given by
(A) $-1 \leq x \leq 1$ (B) $1 \leq x \leq 2$
(C) $2 \leq x \leq 4$ (D) none of these

20. If x is real, then $\frac{x^2 + 2x + c}{x^2 + 4x + 3c}$ can take all real values if
(A) $0 < c < 2$ (B) $-1 < c < 1$ (C) $-1 < c < 1$ (D) none of these

21. If α and β are the roots of the equation $x^2 + px + q = 0$ and α^4, β^4 are the roots of $x^2 - rx + s = 0$ then equation $x^2 - 4qx + 2q^2 - r = 0$ has always
(A) two real roots (B) two positive roots
(C) roots of positive sign (D) two negative roots

22. If one root of equation $x^2 - 3ax + f(a) = 0$, is double of the other then f(x) =
(A) $2x$ (B) x^2
(C) $2x^2$ (D) x

23. If $ax^2 + bx + c = 0$; $a, b, c \in R$; $a \neq 0$, has no real roots then $(a + b + c)c$ is
(A) < 0 (B) $= 1$

(C) = 0 (D) > 0

24. $f(x) = ax^3 + bx^2 + cx + d$ has only one real root at $x = -2$. If $a + b + c + d > 0$, then the value of $8a + 4b + 2c + d$ is
(A) = 0 (B) > 0
(C) < 0 (D) can't determine

25. The equation $(x-3)^9 + (x-3^2)^9 + \ldots + (x-3^9)^9 = 0$ has
(A) all the roots real (B) one real and rest imaginary roots
(C) at least one real root (D) none of these

26. If both roots of the equation $x^2 - 2ax + a^2 - 1 = 0$ lies between -3 and 4, then [a] is, where [.] denotes greatest integer function.
(A) 0, 1, 2 (B) −1, 0, 1, 2
(C) 0, 1, 2, 3 (D) −3, −2, −1, 0

27. The expression $\frac{(x-b)(x-c)}{(a-b)(a-c)} + \frac{(x-c)(x-a)}{(b-c)(b-a)} + \frac{(x-a)(x-b)}{(c-a)(c-a)} = 1$ represents
(A) quadratic expression (B) quadratic equation
(C) identity (D) none of these

28. The number of solutions of the equation $|x^2 - x - 6| = x + 2$, $x \in R$ is
(A) 2 (B) 3
(C) 4 (D) none of these

29. Solutions of $\left(x + \frac{1}{x}\right)^2 = 4 + \frac{3}{2}\left(x - \frac{1}{x}\right)$ are
(A) −1, −2 (B) 1, 2
(C) 1, $\frac{1}{2}$ (D) none of these

30. If f(x) is a quadratic expression such that $f(x) > 0\ \forall\ x \in R$ and if $g(x) = f(x) + f'(x) + f''(x)$ then g(x) is
(A) negative (B) positive
(C) zero (D) none of these

31. If x is real, then the expression $\frac{x^2 + 34x - 71}{x^2 + 2x - 7}$ can have no value between
(A) 3 and 7 (B) 4 and 8
(C) 5 and 9 (D) 6 and 10

32. The set of values of m for which both roots of the equation $x^2 - (m+1)x + m + 4 = 0$ are real and negative consists of all m such that
(A) $-3 < m \le -1$ (B) $-4 < m \le -3$
(C) $-3 \le m \le 5$ (D) $-3 \ge m$ or $m \ge 5$

33. Give that $ax^2 + bx + c = 0$ has no real solution and $a + b + c < 0$ then
(A) c = 0 (B) c > 0
(C) c < 0 (D) none of these

34. The equation $x^2 + ax + b = 0$ and $x^2 + bx + a = 0$ will have a common root. The common root is
(A) −2 (B) 1
(C) 2 (D) none of these

35. If $b > a$, then the equation $(x - a)(x - b) = 1$ has
(A) both roots in $[a, b]$ (B) both roots in $(-\infty, a)$
(C) both roots in (b, ∞) (D) one root in $(-\infty, a)$ and other in (b, ∞)

36. If α and β $(\alpha < \beta)$, be the roots of $x^2 + bx + c = 0$, (where $c < 0 < b$), then
(A) $0 < \alpha < \beta$ (B) $\alpha < 0 < \beta < |\alpha|$
(C) $\alpha < \beta < 0$ (D) $\alpha < 0 < |\alpha| < \beta$

37. If p and q be roots of $x^2 - 2x + A = 0$ and r, s be the roots of $x^2 - 18x + B = 0$, if $p < q < r < s$ are in A.P. Then
(A) $A = -3$, $B = 77$ (B) $A = 77$, $B = -3$
(C) $A = 3$, $B = -77$ (D) none of these

38. The set of values of 'a' for which all the solutions of the equation $(\log_{1/2}x)^2 + 4a\log_{1/2}x + 1 = 0$ are positive and distinct
(A) $(-1, 0)$ (B) R
(C) $(-\infty, -1/2)\cup(1/2, \infty)$ (D) none of these

39. The set of positive integral values of 'a' for which at least one of the roots of the equation $x^2 + (a + 10)x + 10a - 33 = 0$ is a positive integer, is
(A) $\{2\}$ (B) N
(C) $\{1, 3\}$ (D) none of these

40. Sum of the real roots of the equation $x^2 + |x| - 6 = 0$
(A) 1 (B) 0
(C) -1 (D) none of these

41. Find the interval in x for which $\frac{e^x(x^2-4)(x^2+8)}{(x+1)(x+3)} \le 0$ = …………

42. If the expression $\frac{1}{x}\left[mx - 1 + \frac{1}{x}\right]$ is non-negative $\forall$ x $\in$R then minimum value of m must be
(A) - $\frac{1}{2}$ (B) 2 (C) $\frac{1}{4}$ (D) $\frac{1}{2}$

43. If α, β be the roots of $4x^2 - 16x + \lambda = 0$, $\lambda \in R$, such that $1 < \alpha < 2$ and $2 < \beta < 3$ then number of integral solutions of λ is
(A) 5 (B) 6
(C) 2 (D) 3

44. If a is an integer and the equation $(x - a)(x - 10) + 1 = 0$ has integral roots then the value of a are
(A) 10, 8 (B) 12, 10
(C) 12 , 8 (D) none of these

45. The quadratic equations $x^2 + ax + 12 = 0$, $x^2 + bx + 15 = 0$ and $x^2 + (a + b)x + 36 = 0$ have a positive common root (α), given by
(A) $\alpha = 4$ (B) $\alpha = 5$
(C) $\alpha = 10$ (D) $\alpha = 3$

46. The greatest value of $\frac{4}{4x^2+4x+9}$ is

(A) $\frac{4}{9}$ (B) 4
(C) $\frac{9}{4}$ (D) $\frac{1}{2}$

47. The set of values of a for which 1 lies between the roots of $x^2 - ax - a + 3 = 0$ is
(A) $(-\infty, -6)$ (B) $(-\infty, +6)$
(C) $(-\infty, -6) \cup (2, \infty)$ (D) $(2, \infty)$

48. Maximum value of $5 + 4x - x^2$, is
(A) 5 (B) 6
(C) 9 (D) 1

49. The equation $(ax^2 + bx + c)(ax^2 - dx - c) = 0$, $x \neq 0$, has
(A) four real roots (B) at least two real roots
(C) at most two real roots (D) no real roots

50. If the equation $x^2 + 5bx + 8c = 0$, does not have two distinct real roots, then minimum value of $5b + 8c$ is
(A) 1 (B) 2
(C) –2 (D) –1

51. If $a + b + c = 0$, then one root of the equation $ax^2 + bx + c = 0$ is $(a \neq 0)$
(A) –1 (B) 2
(C) 1 (D) 3

52. If the bigger root of $x^2 + 2ax - 6 + 5a = 0$ is negative then exhaustive set of values of a is;
(A) $a \in (6/5\ ,\ 2] \cup [3, \infty)$ (B) $a \in (6/5\ ,\ 3]$
(C) $[2, \infty)$ (D) none of these

53. If $f(x) = ax^2 + bx + 8$ does not have distinct real roots, then the least value of $4a - b$ is
(A) –4 (B) –8 (C) –6 (D) –2

54. If the roots of the equation $x^2 - 2ax + a^2 + a - 3 = 0$ are less than 3, then
(A) $a < 2$ (B) $2 \leq a \leq 3$ (C) $3 < a \leq 4$ (D) $a > 4$

55. If roots of the equation $x^2 - (a + 3)x + 3a - 1 = 0$ are integral, then the value of a is
(A) 3 (B) 2 (C) 1 (D) –2

56. If $ax^2 + bx + c = 0$ has non real roots and $c \in R^+$, then
(A) $a - 2b + 4c < 0$ (B) $a - 2b + 4c > 0$
(C) $a - 2b + 4c = 0$ (D) none of these

57. If $x^3 + ax + b = 0$, $(a, b \in R)$ has a repeated non– zero root, then
(A) ‘a’ has to be necessarily a positive real number.
(B) ‘a’ has to be necessarily a negative real number.
(C) ‘a’ can be any real number.
(D) None of these

58. If $x^2 - 3ax + 2 < 0 \quad \forall\, x \in [1, 3]$ then exhaustive set of values of ‘a’ is
(A) $a \in (1, \infty)$ (B) $a \in (1,\ 11/9)$
(C) $a \in (11/9, \infty)$ (D) none of these

59. If $\frac{x^3}{3} + x^2 - 3x + c = 0$ is of the form $(x - \alpha)^2 (x - \beta)$ then c =

(A) –5/3 (B) 9
(C) –9 (D) 0

60. If a, $a_1, a_2, \ldots, a_n \in R$ then $\sum_{i=1}^{n}(x - a_i)^2$ is the least if x is equal to
(A) $a_1 + a_2 + \ldots + a_n$ (B) $2(a_1 + a_2 + \ldots + a_n)$
(C) $n(a_1 + a_2 + \ldots + a_n)$ (D) none of these

61. The number of real roots of the equation $(x-1)^2 + (x-2)^2 + (x-3)^2 = 0$ is
(A) 3 (B) 2
(C) 1 (D) 0

62. If p and q are the roots of the equation $x^2 + px + q = 0$ then
(A) p =1 (B) p =1 or 0
(C) p = –2 (D) p = –2 or 0

63. The roots α and β of the quadratic equation $ax^2 + bx + c = 0$ are real and of opposite sign. Then the roots of the equation $\alpha(x - \beta)^2 + \beta(x - \alpha)^2 = 0$ are
(A) positive (B) negative (C) real and of opposite sign
(D) imaginary

64. If the inequality $\frac{mx^2 + 3x + 4}{x^2 + 2x + 2} < 5$ is satisfied for all $x \in R$, then
(A) $1 < m < 5$ (B) $-1 < m < 5$ (C) $1 < m < 6$ (D) $m < \frac{71}{24}$.

65. Given real numbers a, b, c and $a \neq 0$. If α is a root of $a^2x^2 + bx + c = 0$, β is a root of $a^2x^2 - bx - c = 0$, and $0<\alpha<\beta$, then the equation $a^2x^2 + 2bx + 2c = 0$ has a root γ that always satisfies
(A) $\gamma = \frac{\alpha + \beta}{2}$, (B) $\gamma = \alpha + \frac{\beta}{2}$ (C) $\gamma = \alpha$, (D) $\alpha < \gamma < \beta$

66. The equation $ax^2 + bx + a = 0$, $x^3 - 2x^2 + 2x - 1 = 0$ have two roots in common. Then a + b must be equal to
(A) 1 (B) −1
(C) 0 (D) none of these

67. If a, b, c are in G.P. then the equation $ax^2 + 2bx + c = 0$ and $dx^2 + 2ex + f = 0$ have a common root if $\frac{d}{a}, \frac{e}{b}, \frac{f}{c}$ are in
(A) A.P. (B) G.P.
(C) H.P. (D) none of these

68. If c > 0 and 4a + c < 2b, then $ax^2 - bx + c = 0$ has a root in the interval
(A) (0, 2) (B) (2, 4)
(C) (0, 1) (D) (-2, 0)

69. The number of real solutions of the equations $e^x = x$ is
(A) 0 (B) 1
(C) 2 (D) infinite

70. The number of real solutions of the equation $3^{\frac{x}{2}} + (\sqrt{2} + 1)^x = (6 + 2\sqrt{2})^{\frac{x}{2}}$ is

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

71. The number of real solutions of the equations $e^{|x|} = |x|$ is
(A) 0 (B) 1 (C) 2 (D) 4

72. The number of numbers between n and n^2 which are divisible by n is ($n \in I$)
(A) n (B) n –1
(C) n –2 (D) none of these

73. If the ratio of the roots of the equation $x^2 + px + q = 0$ be equal to the ratio of the roots of $x^2 + lx + m = 0$, then
(A) $p^2 m = q^2 l$ (B) $pm^2 = q^2 l$
(C) $p^2 l = q^2 m$ (D) $p^2 m = l^2 q$

74. The number of solutions of the equation $5^x + 5^{-x} = \log_{10}25$, $x \in R$ is ……..

75. If $a + b + c = 0$, then the quadratic equation $3ax^2 + 2bx + c = 0$ has
(A) at least one root in (0, 1) (B) one root in (2, 3) and other in (-2, -1)
(C) imaginary root (D) none of these

LEVEL −III

1. If the roots of $x^2 - bx + c = 0$ are the two consecutive integers, then $b^2 - 4c$ is
   (A) 0 (B) 1
   (C) 2 (D) none of these

2. If $a^2 + b^2 + c^2 + d^2 = 1$, then the maximum value of $ab + bc + cd + da$ is
   (A) zero (B) One
   (C) Two (D) None of these

3. The number of real solutions of the equation
   $\cos^5 x + \sin^3 x = 1$ in the interval $[0, 2\pi]$ is
   (A) 2 (B) 1
   (C) 3 (D) Infinite

4. Let $f(x) = ax^3 + bx^2 + x + d$ has local extrema at $x = \alpha$ and β such that $\alpha.\ \beta < 0$, $f(\alpha), f(\beta) > 0$;
   Then the equation $f(x) = 0$
   (A) has 3 distinct real roots
   (B) has only one real root, which is positive if $a\, f(\alpha) < 0$
   (C) has only one real root, which is negative if $a\, f(\beta) > 0$
   (D) has 3 equal real roots

5. If $\sin\alpha$, $\sin\beta$ and $\cos\alpha$ are in GP, then roots of $x^2 + 2x\cot\beta + 1 = 0$ are always
   (A) equal (B) real
   (C) imaginary (D) greater than 1

6. Let $a, b, c, \in R$ such that $2a + 3b + 6c = 0$. Then the quadratic equation $ax^2 + bx + c = 0$ has
   (A) at least one root in (0,1) (B) at least one root in (-1, 0)
   (C) both roots in (1,2) (D) imaginary roots

7. If $ax^2 + bx + 1=0$ does not have 2 distinct real roots then least value of $2a - b$ is _____________

8. If x is real, then least value of expression $\frac{x^2 - 6x + 5}{x^2 + 2x + 1}$ is ;
   (A) –1 (B) –1/2 (C) –1/3 (D) none of these

9. If a, b, c are real and $a + b + c = 0$, then quadratic equation $4ax^2 + 3bx + 2c = 0$ has;
   (A) two real roots (B) two imaginary roots
   (C) one real root only (D) none of these

10. If x is real, then expression $\frac{(x-a)(x-b)}{x-c}$ will assume all real values provided
    (A) a> b> c (B) a< b < c
    (C) a > c > b (D) b > a > c

11. If $x^2 + 2bx + c = 0$ and $x^2 + 2ax - c = 0$ are two quadratic equation then
    (A) at least one has real roots (B) both have real roots
    (C) both have imaginary roots (D) at least one has imaginary root.

12. If the roots of $ax^2 + bx + c = 0$, lies between 1 and 2. Then $9a^2 + 6ab + 4ac$ is
    (A) < 0 (B) = 0
    (C) > 0 (D) can't say

13. For the equation $3x^2 + px + 3 = 0$, $p > 0$ if one of the root is square of the other, then p is equal to

(A) $\frac{1}{3}$ (B) 1

(C) 3 (D) $\frac{2}{3}$

14. If the equation $ax^2 - bx + 5 = 0$ doesn't have two distinct real roots then the minimum value of $a + b$ is

(A) -5 (B) 5

(C) 0 (D) none of these

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

(A) one positive (B) both negative

(C) both positive (D) both complex roots

16. If $f(x) = ax^2 + bx + c$, $g(x) = -ax^2 + bx + c$ where $ac \neq 0$ then $f(x). g(x) = 0$ has

(A) at least three real roots (B) no real roots

(B) at least two real roots (D) exactly two real roots

17. The number of real solutions of the equation $3^x + x^2 = 5$ is

(A) 1 (B) 2

(C) 3 (D) 0

18. The number of real solutions of the equation $\left(\frac{9}{10}\right)^x = -3 + x - x^2$ is

(A) 0 (B) 1

(C) 2 (D) none of these

19. The equation $\sqrt{x + 3 - 4\sqrt{x-1}} + \sqrt{x + 8 - 6\sqrt{x-1}} = 1$ has

(A) no solution (B) only one solution

(C) only two solutions (D) more than two solutions

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

(A) are real and negative (B) have negative real parts

(C) are rational numbers (D) none of these

21. $x^4 - 4x - 1 = 0$ has

(A) exactly one positive real root (B) exactly one negative real root

(C) exactly two real roots (D) All the above.

22. Let a, b, c be non-zero real numbers, such that

$\int_0^1 (1 + \cos^8 x)(ax^2 + bx + c)dx = \int_0^2 (1 + \cos^8 x)(ax^2 + bx + c)dx$. Then the quadratic equation $ax^2 + bx + c = 0$ has

(A) no root in (0, 2) (B) at least one root in (1, 2)

(C) two roots in (0, 2) (D) two imaginary roots.

23. If the two roots of the equation $(\lambda - 1)(x^2 + x + 1)^2 - (\lambda + 1)(x^4 + x^2 + 1) = 0$ are real and distinct, then λ lies in the interval $\lambda < -2, \lambda > 2$.

ANSWERS

LEVEL −I

1.	B	2.	A	3.	D	4.	C
5.	B	6.	C	7.	C	8.	B
9.	A	10.	A	11.	A	12.	B
13.	D	14.	D	15.	C	16.	A
17.	B	18.	D	19.	A	20.	A
21.	C	22.	A	23.	D	24.	A
25.	C	26.	B	27.	A	28.	D
29.	A	30.	B	31.	B	32.	A
33.	C	34.	C	35.	B	36.	B
37.	B	38.	B	39.	C	40.	D
41.	C	42.	B	43.	A	44.	A
45.	B	46.	C	47.	A	48.	C
49.	C	50.	B	51.	B	52.	C
53.	D	54.	B	55.	0	56.	B
57.	B	58.	A	59.	A	60.	C
61.	A	62.	B	63.	B	64.	B
65.	D	66.	D	67.	D	68.	A
69.	A	70.	A	71.	C	72.	A
73.	C	74.	B	75.	A	76.	A
77.	A	78.	B	79.	C	80.	B
81.	C	82.	D	83.	C	84.	B
85.	A	87.	D	88.	B		
89.	B	90.	D	91.	A	92.	B
93.	B	94.	A	95.	B	96.	D
97.	1	98.	3	99.	0	100.	B

LEVEL −II

1.	C	2.	A	3.	A	4.	D
5.	B	6.	B	7.	C	8.	D
9.	B	10.	A	11.	B	12.	A
13.	D	14.	D	15.	A	16.	A
17.	$(-2, \infty)$	18.	A	19.	A, C	20.	D
21.	A	22.	C	23.	D	24.	B
25.	B	26.	B	27.	C	28.	B
29.	B	30.	B	31.	C	32.	B
33.	C	34.	B	35.	D	36.	D
37.	A	38.	C	39.	A	40.	B
41.	$(-3, -2]\cup(-1, 2]$			42.	C	43.	D
44.	C	45.	D	46.	D	47.	D
48.	C	49.	B	50.	D	51.	C
52.	A	53.	D	54.	A	55.	A
55.	B	57.	B	58.	C	59.	C
60.	D	61.	D	62.	B	63.	C
64.	D	65.	D	66.	C	67.	A
68.	A	69.	A	70.	A	71.	A
72.	C	73.	D	74.	0	75.	C

LEVEL −III

1.	B	2.	B	3.	C	4.	B, C
5.	B	6.	A	7.	$-1/2$	8.	C

9.	A	10.	C	11.	A	12.	A
13.	C	14.	A	15.	C	16.	C
17.	A	18.	A	19.	D	20.	B
21.	D	22.	B				

23. $\lambda \in (-\infty, -2) \cup (2, \infty)$