QUADRATIC EQUATIONS

CLASS X (BASIC & STANDARD)

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i) Quadratic equation: A quadratic equation in the variable x is of the form $ax^2 + bx + c = 0$ *where a, b, c are real numbers and* $a \neq 0$.

ii) Roots of a quadratic equation: A real number α is said to be a root of the quadratic equation $ax^2 + bx + c = 0$ *, if* $a\alpha^2 + b\alpha + c = 0$.

iii) The roots of the quadratic equation $ax^2 + bx + c = 0$ *are the same as the zeroes of the quadratic polynomial* $ax^2 + bx + c$

iv) Quadratic Formula: If $b^2 - 4ac \geq 0$ *, then the real roots of the quadratic equation*

$ax^2 + bx + c = 0$ *are given by* $x = \frac{-b \pm \sqrt{b^2-4ac}}{2a}$.

The expression $b^2 - 4ac$ *is called the discriminant of the quadratic equation.*

v) A quadratic equation $ax^2 + bx + c = 0$ *has*

i) two distinct real roots if $b^2 - 4ac > 0$

ii) two equal real roots if $b^2 - 4ac = 0$

iii) no real roots if $b^2 - 4ac < 0$. *(Complex numbers)*

iv) Rational roots if $b^2 - 4ac$ is a perfect square.

PART -1

1. If the roots of the equation $ax^2 = bx + c = 0$, $a \neq 0$ are real and equal, which of the following relation is true? (CBSE 2024)

   (A) $a = \frac{b^2}{c}$ (B) $b^2 = ac$ (C) $ac = \frac{b^2}{4}$ (D) $c = \frac{b^2}{a}$

2. The discriminant of the quadratic equation $2x^2 - 5x - 3 = 0$ is _____ (CBSE 2023)

   (A) 1 (B) 19 (C) 49 (D) 7

3. Which of the following equations is a quadratic equation? (CBSE 2025)

   (A) $x^2 + 1 = (x - 1)^2$ (B) $\left(x + \sqrt{x}\right)^2 = 2x\sqrt{x}$

   (C) $x^3 + 3x^2 = (x + 1)^3$ (D) $(x + 1)(x - 1) = (x + 1)^2$

4. If $x^2 + bx + b = 0$ has two real and distinct roots, then the value of b can be (CBSE 2025)

   (A) 0 (B) 4 (C) 3 (D) -3

5. The quadratic equation $4x^2 + 6x + 3 = 0$ has _____

   (A) two distinct real roots (B) two equal real roots

   (C) no real roots (D) more than 2 real roots

6. For what value of *k*, are the roots of the quadratic equation $3x^2 + 2kx + 27 = 0$ real and equal?

   (A) ± 9 (B) 9 (C) 3 (D) 12

7. If the roots of $ax^2 + bx + c = 0$ are equal in magnitude but opposite in sign, then_____

   (A) a = 0 (B) b = 0 (C) c = 0 (D) none of these

8. If the difference of the roots of the equation $x^2 - bx + c = 0$ be 1, then_____

   (A) $b^2 - 4c + 1 = 0$ (B) $b^2 + 4c = 0$ (C) $b^2 - 4c - 1 = 0$ (D) $b^2 - 4c = 0$

9. Write the nature of roots of quadratic equation $4x^2 + 4\sqrt{3}x + 3 = 0$.

   (A). Distinct non real roots (B) real and unequal roots (C) real and equal roots (D) none

10. Which one of the following equations has no real roots?

    (A) $x^2 - 4x + 3\sqrt{2}$ (B) $x^2 + 4x - 3\sqrt{2}$ (C) $x^2 - 4x - 3\sqrt{2}$ (D) $3x^2 + 4\sqrt{3}x + 4$

11. Find the value of k for which the equation $x^2 - 4x + k = 0$ has equal roots.

    (A) -4 (B) 1 (C) 4 (D) 16

12. The nature of roots of the quadratic equation $4x^2 + 4\sqrt{3}x + 3 = 0$ is _____.

(A) real and equal roots (B) real and distinct roots
(C) no real roots (D) none of these

13. The discriminant (D) of the quadratic equation $\sqrt{3}x^2 + 2\sqrt{2}x - 2\sqrt{3}$ is _____
(A) -32 (B) 4 (C) $\sqrt{32}$ (D) 32

14. Write the nature of roots of the quadratic equation $9x^2 - 6x - 2 = 0$.
(A) Distinct non real roots (B) real and unequal roots (C) real and equal roots (D) none

15. The roots of $ax^2 + bx + c = 0, a \neq 0$ are real and unequal. What is value of D?
(A) $D > 0$ (B) $D < 0$ (C) $D \leq 0$ (D) $D \geq 0$

16. If arithmetic mean of two numbers *a* and *b* is 8 and *ab* = 9, find a quadratic equation whose roots are *a* and *(B)*
(A) $x^2 + 16x + 9 = 0$ (B) $x^2 - 16x + 9 = 0$ (C) $x^2 - 16x - 9 = 0$ (D) $x^2 - 9x + 16 = 0$

17. If $2x^2 - (2 + k)x + k = 0$ where *k* is a real number, find the roots of the equation.
(A) $1, \frac{1}{2}$ (B) $1, \frac{k}{2}$ (C) $k, \frac{k}{2}$ (D) $\frac{k}{2}, \frac{k}{2}$

18. If 2 is a root of the equation $x^2 + bx + 12 = 0$, find the value of *(B)*
(A) 8 (B) – 4 (C) 14 (D) – 8

19. If $3x^2 - 2kx + m = 0$, find *k* when $x = 2$ and $m = 3$.
(A) 15 (B) $\frac{15}{4}$ (C) 14 (D) $\frac{4}{15}$

20. Find the discriminant of the quadratic equation: $3\sqrt{3}x^2 + 10x + \sqrt{3} = 0$.
(A) 8 (B) ± 8 (C) 64 (D) $\sqrt{3}$

21. For what value of *k* does $(k - 12)x^2 + 2(k - 12)x + 2 = 0$ have equal roots?
(A) $k = 14$. (B) $k = 14, 12$ (C) $k = 12$ (D) $k = \pm 14$

22. If the roots of quadratic equation $ax^2 + bx + c = 0$ are equal in magnitude but opposite in sign then find the value of *(B)*
(A) $b = 2$ (B) $b = 1$ (C) $b = 0$ (D) $b = \pm 1$

23. If two roots of $2x^2 + bx + c = 0$ are reciprocal of each other then find the value of c
(A) ± 2 (B) 4 (C) $c = \pm 1$ (D) $c = 2$

24. Which one of the following equations has 2 as a root?
A) $x^2 - 4x + 5 = 0$ B) $x^2 + 3x - 12 = 0$ C) $2x^2 - 7x + 6 = 0$ D) $3x^2 - 6x - 2 = 0$

25. If the roots of the equation $ax^2 + 2bx + c = 0$ are α *and* β, find the value of $\sqrt{\frac{\alpha}{\beta}} + \sqrt{\frac{\beta}{\alpha}}$
A) $\frac{-2b}{\sqrt{ac}}$ B) $\frac{-2c}{\sqrt{ab}}$ C) $\frac{-2}{\sqrt{ac}}$ D) $\frac{-b}{\sqrt{ac}}$

26. If $\frac{1}{2}$ is a root of the equation $x^2 + kx - \frac{5}{4} = 0$ then the value of *k* is
A) 2 B) – 2 C) $\frac{1}{2}$ D) $\frac{1}{4}$

27. Which of the following equations has the sum of its roots as 3?
A) $2x^2 - 3x + 6 = 0$ B) $-x^2 + 3x - 3 = 0$ C) $\sqrt{2}x^2 - \frac{3}{\sqrt{2}}x + 6 = 0$ D) $3x^2 - 3x + 3 = 0$

28. Value (s) of *k* for which the quadratic equation $2x^2 - kx + k = 0$ has equal roots is
A) 0 only B) 4 C) 8 only D) 0, 8

29. The quadratic equation $2x^2 - \sqrt{5}x + 1 = 0$ has
A) two distinct real roots (B) two equal real roots (C) no real roots (D) more than 2 real roots

30. Find the least positive value of k for which $x^2 + kx + 16 = 0$ has real roots.

A) 4 B) 8 C) $\frac{1}{2}$ D) 1

31. Find the value of p for which the roots of the equation $px^2 - 2\sqrt{5}px + 15 = 0$ has two equal roots.

A) p = 3 B) p = 8 C) p = -2 D) p = 0, 3

32. If (1 – b) is a root of quadratic equation $x^2 + bx + (1 - b) = 0$, then its roots are _____

(A) 0, 1 (B) 0, –1 (C) –1, 1 (D) 0, 2

33. If $3x^2 - 2kx + m = 0$, find k when $x = 2$ and $m = 3$.

A) 2 B) $-\frac{5}{4}$ C) $-\frac{15}{4}$ D) $\frac{15}{4}$

34. If the quadratic equation $mx^2 + 2x + m = 0$ has two equal roots, then the values of m are _____ and _____ .

A) 0 and –1 B) 1 and –2 C) 2 and –1 D) 1 and –1

35. Write the nature of roots of the quadratic equation $9x^2 - 6x - 2 = 0$.

A) two unequal real roots B) equal and real roots

C) no real roots D) none of these

36. The hypotenuse of a right triangle is 1 m more than twice the shortest side. If the third side is 7 m more than the shortest side, find the longest side of the triangle.

A) 12 B) 15 C) 16 D) 17

37. Find the discriminant (D) of quadratic equation $4x^2 - 2x - 5 = 0$

A) 82 B) 84 C) -84 D) 80

38. For what value of k , if $x = \sqrt{2}$ is a solution of the equation $kx^2 + \sqrt{2}x - 4 = 0$?

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

39. Which are the following quadratic equations:

A) $(x - 2)(x + 5) = (x - 3)(x + 4) + x^2$ B) $x^2 - 3x + 5 = (x + 5)^2$

C) $x^3 - 3x^2 + 5x = (x - 2)^3$ D) $(x - 7)x = 3x^2 - 5$

40. If the difference of the roots of the equation $x^2 - bx + c = 0$ be 1, then____

(A) $b^2 - 4c + 1 = 0$ (B) $b^2 + 4c = 0$ (C) $b^2 - 4c - 1 = 0$ (D) $b^2 - 4c = 0$

41. Which of the following is a solution of the equation $x^2 - 6x + 5 = 0$?

A) 2 B) 5 C) -5 D) 3

42. Find the value (s) of p for which the quadratic equation given as $(p + 4)x^2 - (p + 1)x + 1 = 0$ has real and equal roots. Also , find the roots of the equation(s) so obtained

43. If x = 2 is a solution of the equation $x^2 - 5x + 6k = 0$, the value of k is _____.

44. The least positive value of k, for which the equation $2x^2 + kx - 4 = 0$ has rational roots , is __

(A) $\pm 2\sqrt{2}$ (B) 2 (C) ± 2 (D) $\sqrt{2}$

45. If (1 – p) is a root of the equation $x^2 + px + 1 - p = 0$, then roots are_____

46. If α, β are roots of the equation $x^2 + 5x + 5 = 0$, then equation whose roots are α + 1 and β + 1 is

(a) $x^2 + 5x - 5 = 0$ (b) $x^2 + 3x + 5 = 0$ (c) $x^2 + 3x + 1 = 0$ (d) $x^2 - 3x + 1 = 0$

47. Which of the following equations has no real roots ?

(a) $x^2 - 4x + 3\sqrt{2} = 0$ (b) $x^2 + 4x - 3\sqrt{2} = 0$

(c) $x^2 - 4x - 3\sqrt{2} = 0$ (d) $3x^2 + 4\sqrt{3}x + 4 = 0$

48. If α, β are roots of $x^2 + 5x + a = 0$ and $2\alpha + 5\beta = -1$, then a is equal to _____.

49. α, β are roots of the equation $(a + 1)x^2 + (2a + 3)x + (3a + 4) = 0$. If $\alpha \cdot \beta = 2$, then $\alpha + \beta =$ _____

50. If the difference of the roots of the equation $x^2 - bx + c = 0$ be 1, then
(a) $b^2 - 4c + 1 = 0$ (b) $b^2 + 4c = 0$
(c) $b^2 - 4c - 1 = 0$ (d) $b^2 - 4c = 0$

51. If the roots of $ax^2 + bx + c = 0$ are equal in magnitude but opposite in sign, then
(a) $a = 0$ (b) $b = 0$ (c) $c = 0$ (d) none of these

52. If $\alpha + \beta = 4$ and $\alpha^3 + \beta^3 = 44$, then α, β are the roots of the equation
(a) $2x^2 - 7x - 7 = 0$ (b) $3x^2 + 8x + 12 = 0$
(c) $3x^2 - 12x + 5 = 0$ (d) none of these

53. If the roots of equation $3x^2 + 2x + (p + 2)(p - 1) = 0$ are of opposite sign then which of the following cannot be the value of p?
(a) 0 (b) -1 (c) $\frac{1}{2}$ (d) -3

54. The value of k for which the equation $x^2 + 2(k + 1)x + k^2 = 0$ has equal roots is

55. If the equation $x^2 - (2 + m)x + (-m^2 - 4m - 4) = 0$ has coincident roots, then
(a) $m = 0, m = 1$ (b) $m = 2, m = 2$ (c) $m = -2, m = -2$ (d) $m = 6, m = 1$

56. If the roots of the equation $12x^2 + mx + 5 = 0$ are in the ratio 3 : 2, then m equals _____.

57. Is $x = -2$ a solution of the equation $x^2 - 2x + 8 = 0$?

58. Find the roots/solution of the quadratic equation by factorisation: $x^2 - 9x + 20 = 0$

59. Solve the following quadratic equation by factorisation: $\sqrt{3}\,x^2 + 10x + 7\sqrt{3} = 0$

60. Write the nature of roots of quadratic equation : $4x^2 + 4\sqrt{3}\,x + 3 = 0$.

61. Write the nature of roots of the quadratic equation $9x^2 - 6x - 2 = 0$.

62. Write the nature of roots of quadratic equation : $4x^2 + 6x + 3 = 0$

63. If $2x^2 - (2 + k)x + k = 0$ where k is a real number, find the roots of the equation.

64. Is $x = -4$ a solution of the equation $2x^2 + 5x - 12 = 0$.

65. If 2 is a root of the equation $x^2 + bx + 12 = 0$, find the value of b.

66. If $3x^2 - 2kx + m = 0$, find k when $x = 2$ and $m = 3$.

67. Find discriminant of the quadratic equation: $4x^2 - 2x^2 + 3 = 0$.

68. Find discriminant of the quadratic equation: $4x^2 - 12x + 9 = 0$.

69. Find discriminant of the quadratic equation: $5x^2 + 5x + 6 = 0$.

70. For what value of k does $(k - 12)\,x^2 + 2(k - 12)x + 2 = 0$ have equal roots?

71. A quadratic equation $ax^2 + bx + c = 0$, $a \neq 0$ has equal roots. What is the value of D?

72. If two roots of $2x^2 + bx + c = 0$ are reciprocal of each other then find the value of c.

73. Two numbers differ by 3 and their product is 504. Find the numbers.

74. Solve the following equation using by quadratic formula: $x^2 + 5x + 5 = 0$.

75. Solve the following equation by using quadratic formula: $9x^2 - 12x + 4 = 0$.

76. Find the value of p so that the quadratic equation $p\,x(x - 3) + 9 = 0$ has two equal roots.

77. If the roots of quadratic equation $ax^2 + bx + c = 0$ are equal in magnitude but opposite in sign then find the value of b.

78. Write the discriminant of the following quadratic equation : (i) $2x^2 - 5x + 3 = 0$

79. Write the discriminant of the following quadratic equation (ii) $x^2 + 2x + 4 = 0$

80. Write the discriminant of iii) $(x - 1)(2x - 1) = 0$

81. Write the discriminant of (iv) $x^2 - 5x + 1 = 0$

82. Using quadratic formula solve the following quadratic equations:
(i) $2x^2 - 2\,x + 1 = 0$ (ii) $2x^2 - 11x + 9 = 0$ (iii) $5x^2 - 9x - 14 = 0$

83. Using quadratic formula solve the following quadratic equation:
i) $5x^2 - 18x - 8 = 0$ ii) $13x^2 + 9\,(x + 1) - (2x + 3)\,(x + 2) = 6$ iii) $x^2 + 3x - 28 = 0$

84. Determine the nature of the roots of the following quadratic equations:
(i) $2x^2 - 3x + 5 = 0$ (ii) $2\,x^2 - 6x + 3 = 0$ (iii) $(3/5)x^2 - (2/3) + 1 = 0$
(iv) $3x^2 - 4\sqrt{3}x + 4 = 0$

85. Find the values of k for which the roots are real and equal in each of the following equations:
(i) $kx^2 + 4x + 1 = 0$ (ii) $kx^2 - 2\sqrt{5}x + 4 = 0$ (iii) $4x^2 - 3kx + 1 = 0$

iv) $x^2 - 2(5 + 2k)x + 3(7 + 10k) = 0$

86. In the following, determine the set of values of k for which the given quadratic equation has real roots:
(i) $2\,x^2 + 3x + k = 0$ **(**ii) $2\,x^2 + x + k = 0$

87. Find the values of k for which the following equations have real and equal roots
(i) $x^2 - 2(k + 1)x + k^2 = 0$ (ii) $k^2\,x^2 - 2\,(2k - 1)x + 4 = 0$

88. Find the values of k for which the given quadratic equation has real and distinct roots.
(i) $k\,x^2 + 2x + 1 = 0$ ii) $k\,x^2 + 6x + 1 = 0$