Concept Review Questions

Directions for questions 1 to 35: Select the correct alternative from the given choices.

1. Factorise: $12x^2 + 23x + 5$
   (A) $(3x + 1)(2x + 5)$ (B) $(4x + 1)(3x + 5)$
   (C) $(6x + 1)(x + 5)$ (D) $(2x + 1)(6x + 5)$

2. Find the roots of the quadratic equation $x^2 - x - 20 = 0$.
   (A) $-5, 4$ (B) $-5, -4$ (C) $5, -4$ (D) $5, 4$

3. What are the roots of the quadratic equation $2x^2 - 5x - 3 = 0$?
   (A) $-1/2, -3$ (B) $1/2, -3$
   (C) $1/2, 3$ (D) $-1/2, 3$

4. Find a quadratic equation whose roots are 3 and 4.
   (A) $x^2 + 7x + 12 = 0$ (B) $x^2 - 7x + 12 = 0$
   (C) $x^2 - 7x - 12 = 0$ (D) $x^2 + 7x - 12 = 0$

5. Find the roots of the quadratic equation $x^2 - 12x + 13 = 0$.
   (A) 1, 13 (B) $-1, -13$
   (C) $6 + \sqrt{23}, 6 - \sqrt{23}$ (D) None of these

6. If the sum of the roots and the product of the roots of a quadratic equation are 13 and 30 respectively, find its roots.
   (A) 10, 3 (B) $-10, -3$ (C) 10, -3 (D) $-10, 3$

7. Find the sum and the product of the roots of the equation $\sqrt{5}\,x^2 + 25x + 2\sqrt{5} = 0$.
   (A) $-5\sqrt{5}, 2$ (B) $5\sqrt{5}, 2$
   (C) $25\sqrt{5}, 2$ (D) $-25\sqrt{5}, 2$

8. The sum of the squares of two consecutive positive integers added to their product is equal to 331. Find the two integers.
   (A) 9, 10 (B) 10, 11 (C) 11, 12 (D) 12, 13

9. The sum of squares of three consecutive positive integers is 869. Find the numbers.
   (A) 14, 15, 16 (B) 15, 16, 17
   (C) 16, 17, 18 (D) 17, 18, 19

10. An integer exceeds its reciprocal by $\frac{143}{12}$. Find the integer.
    (A) 6 (B) -12 (C) 12 (D) -6

11. The roots of the quadratic equation $2x^2 - 7x + 2 = 0$ are
    (A) rational and unequal
    (B) real and equal
    (C) imaginary
    (D) irrational

12. Find the nature of the roots of the quadratic equation $2x^2 + 6x - 5 = 0$.
    (A) Complex conjugates
    (B) Real and equal
    (C) Conjugate surds
    (D) Unequal and rational

13. If the square of the sum of the roots of a quadratic equation is equal to 4 times the product of its roots, the roots are
    (A) complex conjugates.
    (B) equal.
    (C) conjugate surds.
    (D) unequal and rational.

14. Find the value of the discriminant of the equation $3x^2 + 7x + 2 = 0$.
    (A) 6.25 (B) 25 (C) 43 (D) 5

15. How many roots (both real and complex) does $(x^n - a)^2 = 0$ have?
    (A) 2 (B) $n + 1$ (C) $2n$ (D) n

16. Find the signs of the roots of the equation $x^2 + x - 420 = 0$.
    (A) Both are positive.
    (B) Both are negative.
    (C) The roots are of opposite signs with the numerically larger root being positive.
    (D) The roots are of opposite signs with the numerically larger root being negative.

17. Construct a quadratic equation whose roots are 2 more than the roots of the equation $x^2 + 9x + 10 = 0$.
    (A) $x^2 + 5x - 4 = 0$ (B) $x^2 + 13x + 32 = 0$
    (C) $x^2 - 5x - 4 = 0$ (D) $x^2 - 13x + 32 = 0$

18. Construct a quadratic equation whose roots are reciprocals of the roots of the equation $2x^2 + 8x + 5 = 0$.
    (A) $5x^2 + 8x + 2 = 0$
    (B) $8x^2 + 5x + 2 = 0$
    (C) $2x^2 + 5x + 8 = 0$
    (D) $8x^2 + 2x + 5 = 0$

19. Construct a quadratic equation whose roots are one third of the roots of $x^2 + 6x + 10 = 0$.
    (A) $x^2 + 18x + 90 = 0$
    (B) $x^2 + 16x + 80 = 0$
    (C) $9x^2 + 18x + 10 = 0$
    (D) $x^2 + 17x + 90 = 0$

20. The sum of the roots of a quadratic equation is 33 and the product of its roots is 90. Find the sum of the squares of its roots.
    (A) 909 (B) 8034 (C) 36 (D) 729

21. A quadratic equation in x has its roots as reciprocals of each other. The coefficient of x is twice the coefficient of x^2. Find the sum of the squares of its roots.
    (A) 5 (B) 4 (C) 3 (D) 2

22. A quadratic equation in x has the sum of its roots as 19 and the product of its roots as 90. Find the difference of its roots.
    (A) 9 (B) 10 (C) 1 (D) $\sqrt{7739}$

23. If one root of the quadratic equation $4x^2 - 8x + k = 0$, is three times the other root, find the value of k.
    (A) 3 (B) 9 (C) -3 (D) -6

24. The roots of the quadratic equation $(m - k + \ell)$ $x^2 - 2mx + (m - \ell + k) = 0$ are

(A) $1, \frac{\ell + m - k}{k + m - \ell}$ (B) $1, \frac{2m}{\ell + m - k}$

(C) $1, \frac{k + m - \ell}{\ell + m - k}$ (D) $1, \frac{2k}{k - m + \ell}$

25. The square of the sum of the roots of a quadratic equation E is 8 times the product of its roots. Find the value of the square of the sum of the roots divided by the product of the roots of the equation whose roots are reciprocals of those of E.

(A) 8 (B) 1/8 (C) 1 (D) 4

26. Find the common root of $x^2 + 10x + 24 = 0$ and $x^2 + 14x + 48 = 0$.

(A) –6 (B) 6 (C) –8 (D) – 4

27. The expression $\frac{4ac - b^2}{4a}$ represents the maximum/minimum value of the quadratic expression $ax^2 + bx + c$. Which of the following is true?

(A) It represents the maximum value when $a > 0$.
(B) It represents the minimum value when $a < 0$.
(C) Both (A) and (B)
(D) Neither (A) nor (B)

28. The quadratic expression $ax^2 + bx + c$ has its maximum/minimum value at

(A) $-\frac{b}{2a}$ (B) $\frac{b}{2a}$

(C) $\frac{-2b}{a}$ (D) $\frac{2b}{a}$

29. Find the maximum value of the quadratic expression $-3x^2 + 4x + 5$.

(A) 19/3 (B) 31/12 (C) 3/19 (D) – 19/3

30. If α, β, γ and δ are the roots of the equation $ax^4 + bx^3 + cx^2 + dx + e = 0$, then $\alpha + \beta + \gamma + \delta$ is

(A) – b (B) $\frac{-b}{a}$ (C) – e (D) $\frac{-e}{a}$

31. In the above question the value of $\alpha\beta\gamma\delta$ =

(A) –e (B) e (C) $\frac{-e}{a}$ (D) $\frac{e}{a}$

32. The lowest possible degree of an equation, with real coefficients two of whose roots are $\sqrt{3}$ and $3 + 2i$ is:

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

33. Find the degree of the equation $(x^3 - 3)^2 - 6x^5 = 0$

(A) 5 (B) 6
(C) 9 (D) None of these

34. The number of sign changes in the equation $16x^4 - 64x^3 + 56x^2 + 16x - 15 = 0$ is:

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

35. If an equation is such that for every root α, $1/\alpha$ is also a root, the equation is called a reciprocal equation. Which of the following is a reciprocal equation?

(A) $x^4 - 20x^3 + 33x^2 - 20x + 1 = 0$
(B) $3x^6 + x^5 - 27x^4 + 27x^2 - x - 3 = 0$
(C) $x^5 - 5x^3 + 5x^2 - 1 = 0$
(D) All the above