CHAPTER 7

Quadratic Equation

Exercise

1. The number of real roots of $3^{2x^2-7x+7} = 9$ is
   (a) 0 (b) 2
   (c) 1 (d) 4
2. If cos α is a root of $25x^2 - 5x - 12 = 0, -1 < x < 0$. Then the value of sin 2α is
   (a) $\frac{12}{25}$ (b) $\frac{-12}{25}$
   (c) $\frac{-24}{25}$ (d) $\frac{20}{25}$
3. If $ax^2 + bx + c = 0$ is satisfied by every value of x, then
   (a) $b, c = 0$ (b) $c = 0$
   (c) $a = 0$ (d) $a = b = c = 0$
4. If both the roots of the equation $ax^2 + bx + c = 0$ are zero, then
   (a) $b = c = 0$ (b) $b = 0, c \neq 0$
   (c) $b \neq 0, c = 0$ (d) $b \neq 0, c \neq 0$
5. 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) $\pm m^2$
6. The roots of the equation $\log_2(x^2 - 4x + 5) = (x - 2)$ are
   (a) 4, 5 (b) 2, – 3
   (c) 2, 3 (d) 3, 5
7. Let x_1, x_2 be the roots of the equation $x^2 - 3x + p = 0$ and let x_3, x_4 be the roots of the equation $x^2 - 12x + q = 0$. If the numbers x_1, x_2, x_3, x_4 (in order) form an increasing GP, then
   (a) $p = 2, q = 16$ (b) $p = 2, q = 32$
   (c) $p = 4, q = 16$ (d) $p = 4, q = 32$
8. The quadratic equation whose roots are reciprocal of the roots of the equation $ax^2 + bx + c = 0$ is
   (a) $cx^2 + bx + a = 0$ (b) $bx^2 + cx + a = 0$
   (c) $cx^2 + ax + b = 0$ (d) $bx^2 + ax + c = 0$
9. The condition that one root of the equation $ax^2 + bx + c = 0$ may be double of the other, is
   (a) $b^2 = 9ac$ (b) $2b^2 = 9ac$
   (c) $2b^2 = ac$ (d) $b^2 = ac$
10. If α, β are the roots of $x^2 + bx + c = 0$, then the equation whose roots are b and c is
    (a) $x^2 + \alpha x - \beta = 0$
    (b) $x^2 - x(\alpha + \beta + \alpha\beta) - \alpha\beta(\alpha + \beta) = 0$
    (c) $x^2 + (\alpha + \beta - \alpha\beta)x - \alpha\beta(\alpha + \beta) = 0$
    (d) $x^2 + x(\alpha + \beta + \alpha\beta) - \alpha\beta(\alpha + \beta) = 0$
11. Real roots of the equation $x^2 + 5|x| + 4 = 0$ are
    (a) – 1, – 4 (b) 1, 4
    (c) – 4, 4 (d) None of these
12. If $2 + i\sqrt{3}$ is a root of $x^2 + px + q = 0$ where $p, q \in R$, then
    (a) $p = -4, q = 7$ (b) $p = 4, q = 7$
    (c) $p = 4, q = -7$ (d) $p = -4, q = -7$
13. The values of x satisfying
    $x = \sqrt{6 + \sqrt{6 + \sqrt{6 + ...\infty}}}$ are
    (a) 3, – 2 (b) – 2
    (c) 3 (d) None of these
14. The set of values of p for which the roots of the equation $3x^2 + 2x + p(p - 1) = 0$ are of opposite signs is
    (a) $(-\infty, 0)$ (b) $(0, 1)$
    (c) $(1, \infty)$ (d) $(0, \infty)$
15. 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
16. The value of p for which the difference between the roots of the equation $x^2 + px + 8 = 0$ is 2 are
    (a) ± 2 (b) ± 4
    (c) ± 6 (d) ± 8

17. If $f(x) = 2x^2 + mx^2 - 13x + n$ and 2, 3 are roots of the equation $f(x) = 0$, then the values of m and n are
(a) – 5, – 30 (b) – 5, 30
(c) 5, 30 (d) None of these

18. If $7^{\log_7(x^2-4x+5)} = x - 1$ then x may have values
(a) 2, 3 (b) 7
(c) – 2, – 3 (d) 2, – 3

19. If α, β are the roots of $ax^2 + bx + c = 0$ then the equation whose roots are 2 + α, 2 + β is
(a) $ax^2 + x(4a - b) + 4a - 2b + c = 0$
(b) $ax^2 + x(4a - b) + 4a + 2b + c = 0$
(c) $ax^2 + x(b - 4a) + 4a + 2b + c = 0$
(d) $ax^2 + x(b - 4a) + 4a - 2b + c = 0$

20. If 8, 2 are the roots of $x^2 + ax + \beta = 0$, and 3, 3 are the roots of $x^2 + \alpha x + b = 0$, then the roots of $x^2 + ax + b = 0$ are
(a) 8, – 1 (b) – 9, 2
(c) – 8, – 2 (d) 9, 1

21. If $x = 1 + i$ is a root of the equation $x^3 - ix + 1 - i = 0$, then the other real root is
(a) 1 (b) – 1
(c) 0 (d) None of these

22. The number of roots of the quadratic equation $8 \sec^2 \theta - 6 \sec \theta + 1 = 0$ is
(a) infinite (b) 1
(c) 2 (d) 0

23. If the roots of the equation $(a^2 + b^2)x^2 - 2b(a + c)x + (b^2 + c^2) = 0$ are equal then a, b, c are in
(a) GP (b) AP
(c) HP (d) None of these

24. If $x^2 - ax - 21 = 0$ and $x^2 - 3ax + 35 = 0$, $a > 0$ have a common root, then a is equal to
(a) – 4 (b) 4
(c) 2 (d) None of these

25. If the equations $x^2 + bx + c = 0$, $x^2 + cx + b = 0$ $(b \neq c)$ have a common root, then
(a) $b + c = 0$ (b) $b + c - 1 = 0$
(c) $b + c + 1 = 0$ (d) None of the above

26. If α, β are the roots of $ax^2 - 26x + c = 0$ then $\alpha^3\beta^3 + \alpha^2\beta^3 + \alpha^3\beta^2$ is equal to
(a) $\frac{c^2}{a^3}(c+26)$ (b) $\frac{c^2}{a^3}(c-26)$
(c) $\frac{bc^3}{a^3}$ (d) None of these

27. $\sqrt{2+\sqrt{2+\sqrt{2+...}}}$ to ∞ is equal to
(a) –1 (b) $\sqrt{2}$
(c) 2 (d) $\frac{1}{2}$

28. If the quadratic equations $ax^2 + 2cx + b = 0$ and $ax^2 + 2bx + c = 0$ $(b \neq c)$ have a common root, then $a + 4b + 4c$ is equal to
(a) 0 (b) $-\frac{1}{2}$
(c) 2 (d) 1

29. If α, β are the roots of the equation $ax^2 + bx + c = 0$, then $\frac{1}{a\alpha+b} + \frac{1}{a\beta+b}$ is equal to
(a) $\frac{c}{ab}$ (b) $\frac{a}{bc}$
(c) $\frac{b}{ac}$ (d) None of the above

30. The positive value of m for which the roots of the equation $12x^2 + mx + 5 = 0$ are in the ratio 3 : 2 is
(a) $5\sqrt{10}$ (b) $\frac{5\sqrt{10}}{2}$
(c) $\frac{5}{12}$ (d) $\frac{12}{5}$

31. If α and β are the roots of $ax^2 + bx + c = 0$, then the value of $(a\alpha + b)^{-2} + (a\beta + b)^{-2}$ is equal to
(a) $\frac{b^2-2ac}{a^2c^2}$ (b) $\frac{c^2-2ab}{a^2b^2}$
(c) $\frac{a^2-2bc}{b^2c^2}$ (d) None of these

32. If α, β are the roots of the equation $8x^2 - 3x + 27 = 0$ then the value of $\left(\frac{\alpha^2}{\beta}\right)^{1/3} + \left(\frac{\beta^2}{\alpha}\right)^{1/3}$ is
(a) 1/4 (b) 1/3
(c) 7/2 (d) 4

33. If α, β are the roots of the equation $x^2 - (1+n^2)x + \frac{1}{2}(1+n^2+n^4) = 0$, then $\alpha^2 + \beta^2$ is equal to
(a) n^2 (b) $2n^2$
(c) $n^2 + 2$ (d) $-n^2$

34. If $(1 - p)$ is a root of the quadratic equation $x^2 + px + (1 - p) = 0$, then its roots are
(a) 0, 1 (b) –1, 1
(c) 0, – 1 (d) –1, 2

35. In a quadratic equation with leading coefficient 1, a student reads the coefficient 16 of x wrongly as 19 and obtain the roots as – 15 and – 4. The correct roots are
(a) 6, 10 (b) – 6, – 10
(c) – 7, – 9 (d) None of these

36. Ramesh and Mahesh solve an equation. In solving Ramesh commits a mistake in constant term and finds the roots 8 and 2. Mahesh commits a mistake in the

coefficient of x and finds the roots -9 and -1. The correct roots are

(a) $-8, 2$ (b) $9, 1$
(c) $9, -1$ (d) $-8, -2$

37. Two candidates attempt to solve a quadratic equation of the form $x^2 + px + q = 0$. One starts with a wrong value of p and finds the roots to be 2 and 6. The other starts with a wrong value of q and finds the roots to be $2, -9$. The correct roots are

(a) $3, 4$ (b) $5, 3$
(c) $-3, -4$ (d) None of these

38. If one root of the equation $(a^2 - 5a + 3)x^2 + (3a - 1)x + 2 = 0$ be double of the other, then the value of a is

(a) $\frac{2}{3}$ (b) $-\frac{2}{3}$
(c) $\frac{1}{3}$ (d) $-\frac{1}{3}$

39. If the equation $\frac{x^2 - bx}{ax - c} = \frac{m-1}{m+1}$ has roots equal in magnitude but opposite in signs, then m is equal to

(a) $\frac{a+b}{a-b}$ (b) $\frac{a-b}{a+b}$
(c) 0 (d) 1

40. If the equation $\frac{a}{x-a} + \frac{b}{x-b} = 1$ has two roots equal in magnitude and opposite in signs then the value of $a + b$ is

(a) 0 (b) 1
(c) -1 (d) None of these

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

(a) 2 (b) 1
(c) -1 (d) 0

42. If α, β be the roots of $ax^2 + 2bx + c = 0$ and $\alpha + \delta$, $\beta + \delta$ be those of $Ax^2 + 2Bx + C = 0$, then the value of $(b^2 - ac)/(B^2 - AC)$ is

(a) $\left(\frac{a}{A}\right)^2$ (b) $\left(\frac{A}{a}\right)^2$
(c) 0 (d) 1

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

(a) 1 (b) 2
(c) -2 (d) 0

44. The equation $(b - c)x^2 + (c - a)x + (a - b) = 0$ has

(a) equal roots (b) irrational roots
(c) rational roots (d) None of these

45. If $a + b + c = 0$, then the roots of the equation $(c^2 - ab)x^2 - 2(a^2 - bc)x + (b^2 - ac) = 0$ are

(a) imaginary (b) real and equal
(c) real and unequal (d) None of these

46. The value of 'a' for which the quadratic equation $3x^2 + 2(a^2 + 1)x + (a^2 - 3a + 2) = 0$ possesses roots of opposite signs lies in

(a) $(-\infty, 1)$ (b) $(-\infty, 0)$
(c) $(1, 2)$ (d) $\left(\frac{3}{2}, 2\right)$

47. If $x^2 + 2ax + 10 - 3a > 0$ for all $x \in R$, then

(a) $a < -5$ (b) $-5 < a < 2$
(c) $a > 5$ (d) $2 < a < 5$

48. If $(x + a)$ is a factor of both the quadratic polynomial $x^2 + px + q$ and $x^2 + lx + m$, where, p, q, l and m are constants, then which one of the following is correct ?

(a) $a = \frac{m-q}{l-p} (l \neq p)$ (b) $a = \frac{m+q}{l+p} (l \neq -p)$
(c) $l = \frac{m-q}{a-p} (a \neq p)$ (d) $p = \frac{m-q}{a-l} (a \neq l)$

49. If the difference between the roots of the equation $x^2 + ax + 1 = 0$ is less than $\sqrt{5}$, then the set of possible values of a is

(a) $(-3, 3)$ (b) $(-3, \infty)$
(c) $(3, \infty)$ (d) $(-\infty, -3)$

50. If the sum of the roots of $ax^2 + bx + c = 0$ be equal to sum of the squares, then

(a) $2ac = ab + b^2$ (b) $2ab = bc + c^2$
(c) $2bc = ac + c^2$ (d) None of these

51. If α, β are the roots of the equation $x^2 + px + 1 = 0$ and γ, δ are the roots of the equation $x^2 + qx + 1 = 0$, then $(\alpha - \gamma)(\alpha + \delta)(\beta - \gamma)(\beta + \delta)$ is equal to

(a) $q^2 - p^2$ (b) $p^2 - q^2$
(c) $p^2 + q^2$ (d) None of these

52. If a, b are the roots of the equation $x^2 + x + 1 = 0$, then $a^2 + b^2$ is equal to

(a) 1 (b) 2
(c) -1 (d) 3

53. If α, β are the roots of the equation $x^2 + x + 1 = 0$ and $\frac{\alpha}{\beta}, \frac{\beta}{\alpha}$, are roots of the equation $x^2 + px + q = 0$, then p equals to

(a) -1 (b) 1
(c) -2 (d) 2

54. The value of x satisfying $\log_3(x^2 + 4x + 12) = 2$ are

(a) $2, -4$ (b) $1, -3$
(c) $-1, 3$ (d) $-1, -3$

55. The value of $x^2 - 2bx + c$ is positive if

(a) $b^2 - 4c > 0$ (b) $b^2 - 4c < 0$
(c) $c^2 < b$ (d) $b^2 < c$

56. If $x^2 + x + 1$ is a factor of $ax^3 + bx^2 + cx + d$ then the real root of $ax^3 + bx^2 + cx + d = 0$ is

(a) $-\frac{d}{a}$ (b) $\frac{d}{a}$
(c) $\frac{a}{d}$ (d) None of these

57. If the product of the roots of the equation $x^2 - 3kx + 2e^{2\log k} - 1 = 0$ is 7, then the value of k
(a) 1 (b) 2
(c) 3 (d) 4

Directions (Q. Nos. 58–59):
Let α and β ($\alpha < \beta$) be the roots of the equation $x^2 + bx + c = 0$, where $b > 0$ and $c < 0$.

58. Consider the following:
1. $\beta < -\alpha$
2. $\beta < |\alpha|$

Which of the above is/are correct? **[NDA-I 2016]**
(a) Only 1 (b) Only 2
(c) Both 1 and 2 (d) Neither 1 nor 2

59. Consider the following:
1. $\alpha + \beta + \alpha\beta > 0$
2. $\alpha^2\beta + \beta^2\alpha > 0$

Which of the above is/are correct? **[NDA-I 2016]**
(a) Only 1
(b) Only 2
(c) Both 1 and 2
(d) Neither 1 nor 2

60. If $x^2 - px + 4 > 0$ for all real values of x, then which one of the following is correct? **[NDA-I 2016]**
(a) $|p| < 4$ (b) $|p| \le 4$
(c) $|p| > 4$ (d) $|p| \ge 4$

61. If one root of the equation $(l - m)x^2 + lx + 1 = 0$ is double the other and l is real, then what is the greatest value of m?
(a) $-\frac{9}{8}$ (b) $\frac{9}{8}$
(c) $-\frac{8}{9}$ (d) $\frac{8}{9}$

Directions (Q. Nos. 62–63):
Let α and β be the roots of the equation $x^2 - (1 - 2a^2)x + (1 - 2a^2) = 0$.

62. Under what condition does the above equation have real roots? **[NDA-II 2016]**
(a) $a^2 < \frac{1}{2}$ (b) $a^2 > \frac{1}{2}$
(c) $a^2 \le \frac{1}{2}$ (d) $a^2 \ge \frac{1}{2}$

63. Under what condition is $\frac{1}{\alpha^2} + \frac{1}{\beta^2} < 1$? **[NDA-II 2016]**
(a) $a^2 < \frac{1}{2}$ (b) $a^2 > \frac{1}{2}$
(c) $a^2 > 1$ (d) $a^2 \in \left(\frac{1}{3}, \frac{1}{2}\right)$ only

Directions (Q. Nos. 64-65):
$2x^2 + 3x - \alpha = 0$ has roots -2 and β while the equation $x^2 - 3mx + 2m^2 = 0$ has both roots positive, where $\alpha > 0$ and $\beta > 0$.

64. What is the value of α? **[NDA-II 2016]**
(a) $\frac{1}{2}$ (b) 1
(c) 2 (d) 4

65. If β, 2, $2m$ are in GP, then what is the value of $\beta\sqrt{m}$? **[NDA-II 2016]**
(a) 1 (b) 2
(c) 4 (d) 6

66. If $c > 0$ and $4a + c < 2b$, then $ax^2 - bx + c = 0$ has a root in which one of the following intervals? **[NDA-II 2016]**
(a) (0, 2) (b) (2, 3)
(c) (3, 4) (d) (– 2, 0)

67. If both the roots of the equation $x^2 - 2kx + k^2 - 4 = 0$ lie between – 3 and 5, then which one of the following is correct? **[NDA-II 2016]**
(a) $-2 < k < 2$ (b) $-5 < k < 3$
(c) $-3 < k < 5$ (d) $-1 < k < 3$

68. If the difference between the roots of the equation $x^2 + kx + 1 = 0$ is strictly less than 5, where $|k| \ge 2$, then k can be any element of the interval **[NDA-I 2017]**
(a) $(-3, -2] \cup [2, 3)$
(b) $(-3, 3)$
(c) $[-3, -2] \cup [2, 3]$
(d) None of these

69. If the roots of the equation $x^2 + px + q = 0$ are in the same ratio as those of the equation $x^2 + lx + m = 0$, then which one of the following is correct? **[NDA-I 2017]**
(a) $p^2m = l^2q$
(b) $m^2p = l^2q$
(c) $m^2p = q^2l$
(d) $m^2p^2 = l^2q$

70. If the graph of a quadratic polynomial lies entirely above X-axis, then which one of the following is correct? **[NDA-I 2017]**
(a) Both the roots are real
(b) One root is real and the other is complex
(c) Both the roots are complex
(d) Cannot say

ANSWERS

1.	(b)	**2.**	(c)	**3.**	(d)	**4.**	(a)	**5.**	(c)	**6.**	(c)	**7.**	(b)	**8.**	(a)	**9.**	(b)	**10.**	(c)
11.	(d)	**12.**	(a)	**13.**	(c)	**14.**	(b)	**15.**	(b)	**16.**	(c)	**17.**	(d)	**18.**	(a)	**19.**	(d)	**20.**	(d)
21.	(b)	**22.**	(a)	**23.**	(a)	**24.**	(b)	**25.**	(c)	**26.**	(a)	**27.**	(c)	**28.**	(a)	**29.**	(c)	**30.**	(a)
31.	(a)	**32.**	(a)	**33.**	(a)	**34.**	(c)	**35.**	(b)	**36.**	(b)	**37.**	(c)	**38.**	(a)	**39.**	(b)	**40.**	(a)
41.	(b)	**42.**	(a)	**43.**	(a)	**44.**	(c)	**45.**	(b)	**46.**	(c)	**47.**	(b)	**48.**	(a)	**49.**	(a)	**50.**	(a)
51.	(a)	**52.**	(c)	**53.**	(b)	**54.**	(d)	**55.**	(d)	**56.**	(a)	**57.**	(b)	**58.**	(c)	**59.**	(b)	**60.**	(a)
61.	(b)	**62.**	(d)	**63.**	(a)	**64.**	(c)	**65.**	(a)	**66.**	(a)	**67.**	(d)	**68.**	(a)	**69.**	(a)	**70.**	(c)

Explanations

1. (b) $3^{2x^2-7x+7} = 9 = 3^2$
   $\Rightarrow 2x^2 - 7x + 7 = 2$
   $\Rightarrow 2x^2 - 7x + 5 = 0$
   $b^2 - 4ac = 49 - 4(2)(5) > 0$
   So, there are 2 real roots.

2. (c) $25x^2 - 5x - 12 = 0$
   $\Rightarrow (5x - 4)(5x + 3) = 0$
   $x = \frac{4}{5}$ or $-\frac{3}{5}$
   Given $-1 < x < 0$
   So, $x = -\frac{3}{5}$
   $\Rightarrow \cos\alpha = -\frac{3}{5}$ and $\sin\alpha = \frac{4}{5}$
   $\sin 2\alpha = 2\sin\alpha\cos\alpha = -\frac{24}{25}$

3. (d) $ax^2 + bx + c = 0$ is satisfied by every value of x if $a = b = c = 0$

4. (a) Both roots of the equation $ax^2 + bx + c = 0$ are zero.
   Hence, $b = c = 0$

5. (c) $x^2 + mx + m^2 + a = 0$
   Sum of the roots $p + q = -m$
   Product of the roots $pq = m^2 + a$
   $p^2 + q^2 + pq = (p + q)^2 - 2pq + pq$
   $= (p + q)^2 - pq = m^2 - (m^2 + a) = -a$

6. (c) $\log_2 (x^2 - 4x + 5) = x - 2$
   $x^2 - 4x + 5 = 2^{x-2}$
   By Hit and Trial method,
   $x = 2, 3$ satisfies the above equation.

7. (b) $x^2 - 3x + p = 0$ and $x^2 - 12x + q = 0$
   On putting $p = 2$ and $q = 32$ equation becomes $x^2 - 3x + 2 = 0$ and $x^2 - 12x + 32 = 0$ and thus the roots are 1, 2, 4, 8, which forms an increasing G.P. So, $p = 2$ and $q = 32$.

8. (a) $ax^2 + bx + c = 0$
   For reciprocal roots,
   Replace x by $1/x$
   $a\left(\frac{1}{x}\right)^2 + b\left(\frac{1}{x}\right) + c = 0$
   $\Rightarrow cx^2 + bx + a = 0$

9. (b) Let the roots of the equation $ax^2 + bx + c = 0$ be α and 2α.
   Sum of the roots $3\alpha = -\frac{b}{a}$
   Product of the roots $2\alpha^2 = c/a$
   $\Rightarrow 2\left(\frac{-b}{3a}\right)^2 = \frac{c}{a} \Rightarrow 2b^2 = 9ac$

10. (c) $\because$ α and β are the roots of $x^2 + bx + c = 0$
    So, $\alpha + \beta = -b$ and $\alpha\beta = c$
    New roots are b and c.
    Sum of roots $= b + c = -\alpha - \beta + \alpha\beta$
    Product of roots $= bc = -\alpha\beta(\alpha + \beta)$
    Hence, equation is $x^2 - (b + c)x + bc = 0$
    $x^2 + (\alpha + \beta - \alpha\beta)x - \alpha\beta(\alpha + \beta) = 0$

11. (d) $x^2 \geq 0$ and $|x| \geq 0$
    So, $x^2 + 5|x| + 4 \neq 0$
    Hence, number of real roots = 0

12. (a) One root $= 2 + i\sqrt{3}$
    $\Rightarrow$ Other root $= 2 - i\sqrt{3}$
    Sum of roots = 4
    Product of roots = 4 + 3 = 7
    So, equation is $x^2 - 4x + 7 = 0$
    Comparing with $x^2 + px + q = 0$
    we get $p = -4$ and $q = 7$

13. (c) $x = \sqrt{6 + \sqrt{6 + \sqrt{6 + \sqrt{6}}}} \ldots\infty$
    Consecutive factors of $6 = 2 \times 3$

$\because$ There is (+)ve sign.
So, $x = 3$ (greater number}

14. (b) Roots of the equation $3x^2 + 2x + p(p-1) = 0$ are of opposite signs.
So, product of the roots < 0
$\frac{p(p-1)}{3} < 0$
$\Rightarrow p(p-1) < 0$
$\Rightarrow 0 < p < 1$
$\Rightarrow p \in (0, 1)$

15. (b) Roots of the equation $x^2 + px + q = 0$ are p and q.
$\therefore p + q = -p$
$\Rightarrow 2p + q = 0$ ...(i)
and $pq = q \Rightarrow q(p-1) = 0$ ...(ii)
$\Rightarrow q = 0$ or $p = 1$
If $q = 0 \Rightarrow p = 0$ [From (i)]
Hence, $p = 0$ or 1.

16. (c) Let α, β are the roots of the equation.
$x^2 + px + 8 = 0$
$\alpha + \beta = -p$ and $\alpha\beta = 8$
Given $\alpha - \beta = 2$
$\Rightarrow (\alpha + \beta)^2 - 4\alpha\beta = 4$
$\Rightarrow p^2 - 32 = 4 \Rightarrow p^2 = 36$
$\Rightarrow p = \pm 6$

17. (d) Given 2 and 3 are the roots of the equation.
$2x^2 + mx^2 - 13x + n = 0$
So $4m + n = 18$ ...(i)
and $9m + n = 21$ ...(ii)
On solving eqs. (i) and (ii),
$m = \frac{3}{5}$ and $n = \frac{78}{5}$

18. (a) $7^{\log_7(x^2-4x+5)} = x - 1$
$\Rightarrow x^2 - 4x + 5 = x - 1$
$\Rightarrow x^2 - 5x + 6 = 0$
$\Rightarrow (x-2)(x-3) = 0$
$\Rightarrow x = 2, 3$

19. (d) $\alpha + \beta = -\frac{b}{a}$ and $\alpha\beta = \frac{c}{a}$
New roots are $2 + \alpha$ and $2 + \beta$.
So, sum of roots $= 4 + \alpha + \beta = 4 - \frac{b}{a}$
Product of roots $= (2+\alpha)(2+\beta) = 4 + \frac{c}{a} - \frac{2b}{a}$
So, equation is
$$x^2 - \left(4 - \frac{b}{a}\right)x + \left(4 + \frac{c}{a} - \frac{2b}{a}\right) = 0$$
$\Rightarrow ax^2 + (b - 4a)x + (4a + c - 2b) = 0$

20. (d) Roots of equation $x^2 + ax + \beta = 0$ are 8 and 2 while roots of $x^2 + \alpha x + b = 0$ are 3 and 3.
So, $a = -10$ and $b = 9$
Now, $x^2 + ax + b = 0 \Rightarrow x^2 - 10x + 9 = 0$
$\Rightarrow (x-1)(x-9) = 0 \Rightarrow x = 1, 9$

21. (b) By hit and trial method,
$x = -1$ satisfies the given equation.
So, it is the real root.

22. (a) $8\sec^2\theta - 6\sec\theta + 1 = 0$
$\Rightarrow \cos^2\theta - 6\cos\theta + 8 = 0$
$\Rightarrow (\cos\theta - 4)(\cos\theta - 2) = 0$
$\Rightarrow \cos\theta = 4$ or 2
But $-1 \le \cos\theta \le 1$
So, roots are not possible.

23. (a) $(a^2 + b^2)x^2 - 2b(a + c)x + (b^2 + c^2) = 0$
$\therefore$ Root are equal so $B^2 - 4AC = 0$
$4b^2(a + c)^2 = 4(a^2 + b^2)(b^2 + c^2)$
$\Rightarrow b^4 + a^2c^2 - 2ab^2c = 0$
$\Rightarrow (b^2 - ac)^2 = 0$
$\Rightarrow b^2 = ac$
i.e., a, b, c are in G.P.

24. (b) $x^2 - ax - 21 = 0$ and $x^2 - 3ax + 35 = 0$ have a common root.
So, $\frac{x^2}{-35a - 63a} = \frac{-x}{35 + 21} = \frac{1}{-3a + a}$
$= \frac{x^2}{-98a} = \frac{-x}{56} = \frac{1}{-2a}$
I II III
From I and III, $x = 7$
From II and III, $x = \frac{28}{a}$
Hence, $\frac{28}{a} = 7 \Rightarrow a = 4$

25. (c) $x^2 + bx + c = 0$ and $x^2 + cx + b = 0$ have a common root.
So, put $x = 1$
$1 + b + c = 0 \Rightarrow b + c = -1$

26. (a) α, β are the roots of equation $ax^2 - 26x + c = 0$
$\alpha + \beta = \frac{26}{a}; \alpha\beta = \frac{c}{a}$
$\alpha^3\beta^3 + \alpha^2\beta^3 + \alpha^3\beta^2 = \alpha^3\beta^3 + \alpha^2\beta^2(\alpha + \beta)$
$= \frac{c^3}{a^3} + \frac{c^2}{a^2}\left(\frac{26}{a}\right) = \frac{c^2}{a^3}(c + 26)$

27. (c) $x = \sqrt{2 + \sqrt{2 + \sqrt{2 + ...\infty}}}$
Consecutive factors of 2 = 1 and 2
So, $x = 2$

28. (a) $ax^2 + 2cx + b = 0$ and $ax^2 + 2bx + c = 0$ have a common root.
$$\frac{x^2}{2(c^2 - b^2)} = \frac{-x}{ac - ab} = \frac{1}{2ab - 2ac}$$

$$\Rightarrow \frac{x^2}{2(c+b)} = \frac{-x}{a} = \frac{1}{-2a}$$

I II IIII

From I and III, $x^2 = -\frac{(c+b)}{a}$

From II and III, $x = \frac{1}{2}$

$\Rightarrow a = -4c - 4b$

$\Rightarrow a + 4b + 4c = 0$

29. (c) $\alpha + \beta = -\frac{b}{a}, \alpha\beta = \frac{c}{\alpha}$

$$\frac{1}{a\alpha + b} + \frac{1}{a\beta + b} = \frac{a(\alpha+\beta) + 2b}{a^2\alpha\beta + ab(\alpha+\beta) + b^2}$$

$$= \frac{2b + a(-b/a)}{a^2\left(\frac{c}{a}\right) + ab\left(-\frac{b}{a}\right) + b^2} = \frac{b}{ac}$$

30. (a) Let α and β be the roots of the equation $12x^2 + mx + 5 = 0$

Then, $\frac{\alpha}{\beta} = \frac{3}{2} \Rightarrow \alpha = 3k$ and $\beta = 2k$

$$\alpha + \beta = 5k = -\frac{m}{12}$$

$$\Rightarrow k = -\frac{m}{60} \quad \text{...(i)}$$

$$\alpha\beta = 6k^2 = \frac{5}{12}$$

$$\Rightarrow k^2 = \frac{5}{72} \quad \text{...(ii)}$$

From eqs. (i) and (ii),

$m = 5\sqrt{10}$

31. (a) $\alpha + \beta = -b/a;\ \alpha\beta = c/a$

$(a\alpha + b)^{-2} + (\alpha\beta + b)^{-2}$

$$= \frac{1}{a^2\left\{\alpha + \frac{b}{a}\right\}^2} + \frac{1}{a^2\left\{\beta + \frac{b}{a}\right\}^2}$$

$$= \frac{1}{a^2\{\alpha - \alpha - \beta\}^2} + \frac{1}{a^2\{\beta - \alpha - \beta\}^2}$$

$$= \frac{1}{a^2}\left\{\frac{1}{\beta^2} + \frac{1}{\alpha^2}\right\} = \frac{1}{a^2}\left\{\frac{\alpha^2 + \beta^2}{\alpha^2\beta^2}\right\}$$

$$= \frac{1}{a^2}\left\{\frac{(\alpha+\beta)^2 - 2\alpha\beta}{\alpha^2\beta^2}\right\}$$

$$= \frac{1}{a^2}\left\{\frac{\frac{b^2}{a^2} - \frac{2c}{a}}{\frac{c^2}{a^2}}\right\} = \frac{b^2 - 2ac}{a^2c^2}$$

32. (a) $\alpha + \beta = 3/8;\ \alpha\beta = 27/8$

$$\left(\frac{\alpha^2}{\beta}\right)^{1/3} + \left(\frac{\beta^2}{\alpha}\right)^{1/3}$$

$$= \frac{\alpha^{2/3}.\alpha^{1/3} + \beta^{2/3}.\beta^{1/3}}{(\alpha\beta)^{1/3}}$$

$$= \frac{\alpha+\beta}{(\alpha\beta)^{1/3}} = \frac{3/8}{3/2} = \frac{1}{4}$$

33. (a) $\alpha + \beta = n^2 + 1; \alpha\beta = \frac{n^4 + n^2 + 1}{2}$

$\alpha^2 + \beta^2 = (\alpha + \beta)^2 - 2\alpha\beta$

$= n^4 + 1 + 2n^2 - n^4 - n^2 - 1 = n^2$

34. (c) $1 - p$ is the root of $x^2 + px + (1 - p) = 0$

So, $(1 - p)^2 + p(1 - p) + (1 - p) = 0$

$\Rightarrow (1 - p)\{(1 - p + p + 1)\} = 0$

$\Rightarrow 1 - p = 0 \Rightarrow p = 1$

If $p = 1$, then equation is $x^2 + x = 0$ and roots are 0, – 1.

35. (b) Let the equation be

$ax^2 + bx + c = 0$

Given leading coefficient $a = 1$

So, the equation will become $x^2 + bx + c = 0$

Correct coefficient of $x = 16$

So, correct product of roots

$= (-15) \times (-4) = 60$

So, equation will be

$x^2 + 16x + 60 = 0$

$(x + 10)(x + 6) = 0$

$x = -6, -10$

36. (b) Let the equation be $x^2 + ax + b = 0$

Ramesh commits a mistake in constant and find roots 8 and 2.

$\Rightarrow$ He makes mistake in product of roots, sum is correct.

So, sum of roots = 8 + 2 = 10

While Mahesh commits mistake in coefficient of x and find roots – 9 and – 1.

$\Rightarrow$ He makes mistake in sum of roots, product is correct.

So, product of roots $= -9 \times -1 = 9$

Hence, equation is $x^2 - 10x + 9 = 0$

$\Rightarrow$ Correct roots are 9 and 1.

37. (c) Same as Q. 36.

Correct roots are –3 and – 4.

38. (a) Let roots are α and 2α. Then

$$\alpha + 2\alpha = \frac{-(3a-1)}{a^2 - 5a + 3}$$

$$\Rightarrow \alpha = \frac{1 - 3a}{3(a^2 - 5a + 3)}$$

and $2\alpha^2 = \dfrac{2}{a^2 - 5a + 3}$

or $\dfrac{(1-3a)^2}{9(a^2-5a+3)^2} = \dfrac{1}{a^2-5a+3}$

$\Rightarrow 1 + 9a^2 - 6a = 9a^2 - 45a + 27$

$\Rightarrow 39a = 26$

$\Rightarrow a = \dfrac{26}{39} = \dfrac{2}{3}$

39. (b) $\dfrac{x^2 - bx}{ax - c} = \dfrac{m-1}{m+1}$

$\Rightarrow (m + 1)x^2 - x\{b(m + 1) + a(m - 1)\} + (m - 1)c = 0$

Roots are equal in magnitude and opposite in sign.
So, sum of roots = 0

i.e., $\dfrac{b(m+1) + a(m-1)}{m+1} = 0$

$\Rightarrow m = \dfrac{a-b}{a+b}$

40. (a) $\dfrac{a}{x-a} + \dfrac{b}{x-b} = 1$

$\Rightarrow x^2 - 2(a + b)x + 3ab = 0$

Roots are equal in magnitude and opposite in signs.
So, sum of roots = 0

$\Rightarrow a + b = 0$

41. (b) $\alpha + \beta = p,\ \alpha\beta = -p - c$

$(\alpha + 1)(\beta + 1) = \alpha\beta + (\alpha + \beta) + 1$

$= p - p - c + 1 = 1 - c$

Then $\dfrac{\alpha^2 + 2\alpha + 1}{\alpha^2 + 2\alpha + c} + \dfrac{\beta^2 + 2\beta + 1}{\beta^2 + 2\beta + c}$

$= \dfrac{(\alpha+1)^2}{(\alpha+1)^2 - (1-c)} + \dfrac{(\beta+1)^2}{(\beta+1)^2 - (1-c)}$

$= \dfrac{(\alpha+1)^2}{(\alpha+1)^2 - (\alpha+1)(\beta+1)} + \dfrac{(\beta+1)^2}{(\beta+1)^2 - (\beta+1)(\alpha+1)}$

$= \dfrac{\alpha+1}{\alpha-\beta} + \dfrac{\beta+1}{\beta-\alpha}$

$= \dfrac{\alpha-\beta}{\alpha-\beta} = 1$

42. (a) $\alpha + \beta = \dfrac{-2b}{a}; \alpha\beta = \dfrac{c}{a}$

and $(\alpha+\delta)(\beta+\delta) = \dfrac{C}{A}$

$(\alpha+\delta) + (\beta+\delta) = -\dfrac{2B}{A}$

Now $\{(\alpha+\delta) - (\beta+\delta)^2\} = (\alpha-\beta)^2$

$\{(\alpha+\delta) - (\beta+\delta)\}^2 - 4(\alpha+\delta)(\beta+\delta)$

$= (\alpha + \beta)^2 - 4\alpha\beta$

$\Rightarrow \dfrac{4B^2}{A^2} - \dfrac{4C}{A} = \dfrac{4b^2}{a^2} - \dfrac{4c}{a}$

$\Rightarrow \dfrac{B^2 - AC}{A^2} = \dfrac{b^2 - ac}{a^2}$

$\Rightarrow \dfrac{b^2 - ac}{B^2 - AC} = \left(\dfrac{a}{A}\right)^2$

43. (a) To be identity

$\lambda^3 - 3\lambda + 2 = 0,\ \lambda^2 - 5\lambda + 6 = 0$ and $\lambda^2 - 4 = 0$

$\Rightarrow \lambda = 1$ or 2 and $\lambda = 2$ or 3 and $\lambda = 2$ or -2

$\Rightarrow \lambda = 2$

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

$B^2 - 4AC = (c - a)^2 - 4(b - c)(a - b)$

$= c^2 + a^2 + 4b^2 + 2ac - 4ab - 4ac$

$= (c + a - 2b)^2$ = Perfect square

So, roots are rational.

45. (b) For $(c^2 - ab)x^2 - 2(a^2 - bc)x + (b^2 - ac) = 0$

$B^2 - 4AC$

$= 4(a^2 - bc)^2 - 4(c^2 - ab)(b^2 - ac)$

$= 4\{a^4 + ab^3 + ac^3 - 3a^2bc\}$

$= 4a(a^3 + b^3 + c^3 - 3abc)$

$\{\because a + b + c = 0 \Rightarrow a^3 + b^3 + c^3 = 3abc\}$

$\Rightarrow$ Roots are real and equal.

46. (c) Roots are of opposite sign.
So, product of roots < 0

$\Rightarrow \dfrac{a^2 - 3a + 2}{3} < 0$

$\Rightarrow (a - 1)(a - 2) < 0$

$\Rightarrow 1 < a < 2$

47. (b) $x^2 + 2ax + 10 - 3a > 0$

$\Rightarrow 4a^2 - 4(10 - 3a) < 0$

$\Rightarrow a^2 + 3a - 10 < 0$

$\Rightarrow (a + 5)(a - 2) < 0$

$\Rightarrow -5 < a < 2$

48. (a) Put $x = -a$ in both the given equations.

$a^2 - pa + q = 0 \Rightarrow a^2 = pa - q$

and $a^2 - la + m = 0 \Rightarrow a^2 = la - m$

So, $pa - q = la - m$

or $a = \dfrac{q-m}{p-l} (p \neq l)$

49. (a) Let α, β be the roots of $x^2 + ax + 1 = 0$

$\therefore \alpha + \beta = -a$ and $\alpha\beta = 1$

Given $\alpha - \beta < \sqrt{5}$

or $(\alpha - \beta)^2 < 5$ or $(\alpha + \beta)^2 - 4\alpha\beta < 5$

$\Rightarrow a^2 - 4 < 5$

$\Rightarrow a^2 - 9 < 0$

$\Rightarrow (a + 3)(a - 3) < 0$

$\Rightarrow -3 < a < 3$

50. (a) Let α, β are the roots of $ax^2 + bx + c = 0$.

$\therefore \alpha + \beta = -b/a$ and $\alpha\beta = c/a$

Given $\alpha + \beta = \alpha^2 + \beta^2$

or $\alpha + \beta = (\alpha + \beta)^2 - 2\alpha\beta$

$\Rightarrow -\frac{b}{a} = \frac{b^2}{a^2} - \frac{2c}{a}$

$\Rightarrow 2ac = ab + b^2$

51. (a) α, β are the roots of $x^2 + px + 1 = 0$

$\Rightarrow \alpha + \beta = -p$ and $\alpha\beta = 1$

γ, δ are the roots of $x^2 + qx + 1 = 0$

$\Rightarrow \gamma + \delta = -q$ and $\gamma\delta = 1$

So, $(\alpha - \gamma)(\alpha + \delta)(\beta - \gamma)(\beta + \delta)$

$= [\alpha\beta - \gamma(\alpha + \beta) + \gamma^2][\alpha\beta + \delta(\alpha + \beta) + \delta^2]$

$= [1 + p\gamma + y^2][1 - p\delta + \delta^2]$

$= [q\gamma + p\gamma][q\delta - p\delta]$

$\{\because \gamma^2 + q\gamma + 1 = 0$ and $\delta^2 + q\delta + 1 = 0\}$

$= (p + q)\gamma(q - p)\delta$

$= (q^2 - p^2)\gamma\delta = q^2 - p^2$

52. (c) Roots of $x^2 + x + 1 = 0$ are ω and ω^2.

So, $a = \omega$ and $b = \omega^2$

$a^2 + b^2 = \omega^2 + \omega^4 = \omega^2 + \omega = -1$

53. (b) Roots of the equation $x^2 + x + 1 = 0$ are ω and ω^2.

Let $\alpha = \omega$ and $\beta = \omega^2$

Then, $\frac{\alpha}{\beta} = \frac{1}{\omega}$ and $\frac{\beta}{\alpha} = \omega$

Sum of the roots $\frac{\alpha}{\beta} + \frac{\beta}{\alpha} = -p$

$\Rightarrow \frac{1}{\omega} + \omega = -p \Rightarrow \frac{1 + \omega^2}{\omega} = -p$

$\Rightarrow -\frac{\omega}{\omega} = -p \Rightarrow p = 1$

54. (d) $\log_3(x^2 + 4x + 12) = 2$

$\Rightarrow x^2 + 4x + 12 = 3^2$

$\Rightarrow x^2 + 4x + 3 = 0$

$\Rightarrow (x + 1)(x + 3) = 0$

$\Rightarrow x = -1$ or $x = -3$

55. (d) $x^2 - 2bx + c > 0$

If $4b^2 - 4c < 0$ $\{\because b^2 - 4ac < 0\}$

$\Rightarrow b^2 < c$

56. (a) Factors of $x^2 + x + 1$ are ω and ω^2.

They are also the factor of

$ax^3 + bx^2 + cx + d$

i.e., ω and ω^2 are the roots of $ax^3 + bx^2 + cx + d = 0$

So, product of roots $\alpha\beta\gamma = -\frac{d}{a}$

$\omega.\omega^2\gamma = \frac{d}{a}$

So, third root $= -\frac{d}{a}$ $\{\because \omega^3 = 1\}$

57. (b) Product of roots = 7

$2e^{2\log k} - 1 = 7$

$e^{2\log k} = 4$

$\Rightarrow k^2 = 4 \Rightarrow k = 2$

58. (c) $\because$ α and β are the roots of $x^2 + bx + c = 0$

So, $\alpha + \beta = -b$ and $\alpha\beta = c$

Given, $b > 0$ and $c < 0$

$\Rightarrow$ $\alpha + \beta < 0$ and $\alpha\beta < 0$ …(i)

This is possible only when one of α and β is negative and the negative number is such that its magnitude is greater than β.

Given, $\alpha < \beta$

$\Rightarrow \alpha < 0$ and $\beta > 0$

So, $\beta < -\alpha$ and $\beta < |\alpha|$

So, both the statements are correct.

59. (b) $\alpha + \beta + \alpha\beta < 0$ {From eq. (i) of Q. 58}

So, statement 1 is not correct.

And $\alpha^2\beta + \beta^2\alpha = \alpha\beta(\alpha + \beta)$

$= (-)(-) = (+)$

i.e., $\alpha^2\beta + \beta^2\alpha > 0$

So, statement 2 is correct.

60. (a) Given, $x^2 - px + 4 > 0$

$\Rightarrow (-p)^2 - 4(1)(4) < 0$ $\{\because b^2 - 4ac < 0\}$

$\Rightarrow p^2 - 16 < 0$

$\Rightarrow p^2 < 16$

$\Rightarrow |p| < 4$

61. (b) Let the roots of the equation $(l - m)x^2 + lx + 1 = 0$ and α and 2α.

Then, $\alpha + 2\alpha = \frac{-l}{l - m}$ and $\alpha(2\alpha) = \frac{1}{l - m}$

$\Rightarrow \alpha = \frac{l}{3(m - l)}$ and $2\alpha^2 = \frac{1}{l - m}$

$\Rightarrow \frac{2l^2}{9(m - l)^2} = \frac{1}{(l - m)}$

$\Rightarrow 2l^2 = 9(l - m)$

$\Rightarrow 2l^2 - 9l + 9m = 0$

$\because$ l is real (given) $\{b^2 - 4ac \geq 0\}$

$\Rightarrow 81 - 4(2)(9m) \geq 0$

$\Rightarrow 8 \times 9m \leq 81$

$\Rightarrow m \leq \frac{9}{8}$

So, greater value of $m = \frac{9}{8}$

62. (d) Given, α, β are the roots of

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

For real roots

$(1 - 2a^2)^2 - 4(1)(1 - 2a^2) \geq 0$

$\Rightarrow (1 - 2a^2)(1 - 2a^2 - 4) \geq 0$

$\Rightarrow (2a^2 - 1)(2a^2 + 3) \geq 0$

$\Rightarrow 2a^2 - 1 \geq 0$ $\{\because 2a^2 + 3 \geq 0\}$

$\Rightarrow a^2 \geq \frac{1}{2}$

63. (a) Here, $\alpha + \beta = 1 - 2a^2$ and $\alpha\beta = 1 - 2a^2$

Given, $\frac{1}{\alpha^2} + \frac{1}{\beta^2} < 1$

$\Rightarrow \alpha^2 + \beta^2 < \alpha^2 \beta^2$
$\Rightarrow (\alpha + \beta)^2 - 2\alpha\beta < (\alpha\beta)^2$
$\Rightarrow (1 - 2a^2)^2 - 2(1 - 2a^2) < (1 - 2a^2)^2$
$\Rightarrow 1 - 2a^2 > 0$
$\Rightarrow a^2 < \frac{1}{2}$

64. (c) Given, – 2 is the root of the equation
$2x^2 + 3x - \alpha = 0$
$\Rightarrow 8 - 6 - \alpha = 0$
$\Rightarrow \alpha = 2$
So, eq. becomes $2x^2 + 3x - 2 = 0$
$\Rightarrow (2x - 1)(x + 2) = 0$
$\Rightarrow x = \frac{1}{2}, x = -2$
So, other root $\beta = \frac{1}{2}$

65. (a) From solution of Q. 64, $\beta = \frac{1}{2}$
Given, β, 2, $2m$ are in GP.
$\Rightarrow (2)^2 = \beta(2m)$
$\Rightarrow 2 = \beta m$
Putting $\beta = \frac{1}{2}$, we get $m = 4$
Now, $\beta\sqrt{m} = \frac{1}{2} \times 2 = 1$

66. (a) Let $f(x) = ax^2 - bx + c$
Then, $f(0) = c$
and $f(2) = 4a - 2b + c$
Given, $c > 0$ and $4a - 2b + c < 0$
$\Rightarrow f(0) > 0$ and $f(2) < 0$
Hence, $f(x) = 0$ has both roots lying between 0 and 2 i.e., in the interval (0, 2).

67. (d) $x^2 - 2kx + k^2 - 4 = 0$
$\Rightarrow x = \frac{2k \pm \sqrt{4k^2 - 4(k^2 - 4)}}{2}$
$\Rightarrow x = k \pm 2$
Given, roots lie between – 3 and 5.
$\Rightarrow -3 \le k \pm 2 \le 5$
$\Rightarrow -3 < k - 2 < 5$ and $-3 < k + 2 < 5$
$\Rightarrow -1 < k < 7$ and $-5 < k < 3$
Hence, the correct answer is $-1 < k < 3$.

68. (a) Let α and β are the roots of equation $x^2 + kx + 1 = 0$.
Then, $\alpha + \beta = -k$ and $\alpha\beta = 1$
Given, $\alpha - \beta < \sqrt{5}$
$\Rightarrow (\alpha - \beta)^2 < 5$
$\Rightarrow (\alpha + \beta)^2 - 4\alpha\beta < 5$
$\Rightarrow k^2 - 4 < 5 \Rightarrow k^2 < 9$
$\Rightarrow |k| < 3$
$\Rightarrow -3 < k < 3$ …(i)
Also given $|k| \ge 2$
$\Rightarrow k \le -2$ or $k \ge 2$ …(ii)
From (i) and (ii),
$-3 < k \le -2$ or $2 \le k < 3$
$\Rightarrow k \in (-3, -2] \cup [2, 3)$

69. (a) Let α, β be the roots of $x^2 + px + q = 0$ and γ, δ be the roots of $x^2 + lx + m = 0$
So, $\alpha + \beta = -p, \gamma + \delta = -1$
$\alpha\beta = q, \gamma\delta = m$
Given, $\frac{\alpha}{\beta} = \frac{\gamma}{\delta}$
By Componendo Dividendo Theorem
$\frac{\alpha + \beta}{\alpha - \beta} = \frac{\gamma + \delta}{\gamma - \delta}$
$\frac{p}{l} = \frac{\alpha - \beta}{\gamma - \delta}$
$\frac{p^2}{l^2} = \frac{(\alpha + \beta)^2 - 4\alpha\beta}{(\gamma + \delta)^2 - 4\gamma\delta}$
$\frac{p^2}{l^2} = \frac{p^2 - 4q}{l^2 - 4m}$
$\Rightarrow p^2 m = l^2 q$

70. (c) Let the quadratic polynomial be $ax^2 + bx + c$
Given, $ax^2 + bx + c > 0$
$\Rightarrow b^2 - 4ac < 0, a > 0$
$\Rightarrow$ Both roots are imaginary, i.e., complex.