



# Assignment

## Solution of Quadratic equations

### Basic Level

- A real root of the equation  $\log_4\{\log_2(\sqrt{x+8}-\sqrt{x})\}=0$  is [AMU 1999]

(a) 1 (b) 2 (c) 3 (d) 4
- The roots of the equation  $7^{\log_7(x^2-4x+5)}=x-1$  are

(a) 4, 5 (b) 2, -3 (c) 2, 3 (d) 3, 5
- The solution set of the equation  $\log_x 2 \cdot \log_{2x} 2 = \log_{4x} 2$  is

(a)  $\{2^{-\sqrt{2}}, 2^{\sqrt{2}}\}$  (b)  $\{\frac{1}{2}, 2\}$  (c)  $\{\frac{1}{4}, 2^2\}$  (d) None of these
- The solution of the equation  $3^{\log_a x} + 3x^{\log_a 3} = 2$  is given by

(a)  $3^{\log_2 a}$  (b)  $3^{-\log_2 a}$  (c)  $2^{\log_3 a}$  (d)  $2^{-\log_3 a}$
- If  $3^{x+1} = 6^{\log_2 3}$ , then  $x$  is

(a) 3 (b) 2 (c)  $\log_3 2$  (d)  $\log_2 3$
- The solution of  $|x/(x-1)| + |x| = x^2 / |x-1|$  is

(a)  $x \geq 0$  (b)  $x > 0$  (c)  $x \in (1, \alpha)$  (d) None of these
- If  $2 \log(x+1) - \log(x^2-1) = \log 2$ , then  $x$  equals

(a) 1 (b) 0 (c) 2 (d) 3
- The real roots of the equation  $x^2 + 5|x| + 4 = 0$  are [MNR 1993]

(a)  $\{-1, -4\}$  (b)  $\{1, 4\}$  (c)  $\{-4, 4\}$  (d) None of these
- If  $|x^2 - x - 6| = x + 2$ , then the values of  $x$  are [Roorkee 1982; Rajasthan PET 1992]

(a)  $-2, 2, -4$  (b)  $-2, 2, 4$  (c)  $3, 2, -2$  (d)  $4, 4, 3$
- $\{x \in R : |x-2| = x^2\} =$  [EAMCET 2000]

(a)  $\{-1, 2\}$  (b)  $\{1, 2\}$  (c)  $\{-1, -2\}$  (d)  $\{1, -2\}$
- If  $ax^2 + bx + c = 0$ , then  $x =$  [MP PET 1995]

(a)  $\frac{b \pm \sqrt{b^2 - 4ac}}{2a}$  (b)  $\frac{-b \pm \sqrt{b^2 - ac}}{2a}$  (c)  $\frac{2c}{-b \pm \sqrt{b^2 - 4ac}}$  (d) None of these
- If  $x^{2/3} - 7x^{1/3} + 10 = 0$ , then  $x =$  [BIT Ranchi 1992]

(a)  $\{125\}$  (b)  $\{8\}$  (c)  $\phi$  (d)  $\{125, 8\}$
- The roots of the given equation  $(p-q)x^2 + (q-r)x + (r-p) = 0$  are [Rajasthan PET 1986; MP PET 1999]

(a)  $\frac{p-q}{r-p}, 1$  (b)  $\frac{q-r}{p-q}, 1$  (c)  $\frac{r-p}{p-q}, 1$  (d)  $1, \frac{q-r}{p-q}$
- The solution of the equation  $x + \frac{1}{x} = 2$  will be [MNR 1983]

- (a) 2, -1                      (b)  $0, -1, -\frac{1}{5}$                       (c)  $-1, -\frac{1}{5}$                       (d) None of these
15. One root of the following given equation  $2x^5 - 14x^4 + 31x^3 - 64x^2 + 19x + 130 = 0$  is [MP PET 1985]  
 (a) 1                      (b) 3                      (c) 5                      (d) 7
16. The roots of the equation  $x^4 - 4x^3 + 6x^2 - 4x + 1 = 0$  are [MP PET 1986]  
 (a) 1, 1, 1, 1                      (b) 2, 2, 2, 2                      (c) 3, 1, 3, 1                      (d) 1, 2, 1, 2
17. One root of the equation  $(x+1)(x+3)(x+2)(x+4) = 120$  is [T.S. Rajendra 1991]  
 (a) -1                      (b) 2                      (c) 1                      (d) 0
18. If  $9^x - 4 \times 3^{x+2} + 3^5 = 0$ , then the solution pair is  
 (a) (1, 2)                      (b) (2, 3)                      (c) (2, 4)                      (d) (1, 3)
19. In the equation  $4^{x+2} = 2^{2x+3} + 48$ , the value of  $x$  will be  
 (a)  $-\frac{3}{2}$                       (b) -2                      (c) -3                      (d) 1
20. The roots of the equation  $4^x - 3 \cdot 2^{x+3} + 128 = 0$  are [AMU 1985]  
 (a) 1 and 2                      (b) 2 and 3                      (c) 3 and 4                      (d) 4 and 5
21. The root of the equation  $\sqrt{2x-2} + \sqrt{x-3} = 2$  is [Roorkee 1979]  
 (a) 3                      (b) 19                      (c) 3, 19                      (d) 3, -19
22. The solution of the equation  $\sqrt{x+1} + \sqrt{x-1} = 0$  is [IIT 1978]  
 (a) 1                      (b) -1                      (c)  $\frac{5}{4}$                       (d) None of these
23. If  $x = \sqrt{6 + \sqrt{6 + \sqrt{6 + \dots}}}$  to  $\infty$ , then [Pb.CET 1999]  
 (a)  $x$  is an irrational number (b)  $2 < x < 3$                       (c)  $x = 3$                       (d)
24. The real values of  $x$  which satisfy the equation  $(5 + 2\sqrt{6})^{x^2-3} + (5 - 2\sqrt{6})^{x^2-3} = 10$  are [Kurukshehra CEE 1995; Karnataka CET 1993]  
 (a)  $\pm 2$                       (b)  $\pm \sqrt{2}$                       (c)  $\pm 2, \pm \sqrt{2}$                       (d)  $2, \sqrt{2}$
25. If one root of the equation  $a(b-c)x^2 + b(c-a)x + c(a-b) = 0$  is 1 then, its other roots is [Rajasthan PET 1986]  
 (a)  $\frac{a(b-c)}{b(c-a)}$                       (b)  $\frac{c(a-b)}{a(b-c)}$                       (c)  $\frac{b(c-a)}{a(b-c)}$                       (d) None of these
26. The imaginary roots of the equation  $(x^2 + 2)^2 + 8x^2 = 6x(x^2 + 2)$  are [Roorkee 1986]  
 (a)  $1 \pm i$                       (b)  $2 \pm i$                       (c)  $-1 \pm i$                       (d) None of these
27. GM of the roots of the equation  $x^2 - 18x + 9 = 0$  is [Rajasthan PET 1997]  
 (a) 6                      (b) 3                      (c) -3                      (d)  $\pm 3$
28. The solution set of the equation  $(x+1)^2 + [x-1]^2 = (x-1)^2 + [x+1]^2$  is  
 (a)  $x \in R$                       (b)  $x \in N$                       (c)  $x \in I$                       (d)  $x \in Q$
29.  $\left[\frac{1}{4}\right] + \left[\frac{1}{4} + \frac{1}{200}\right] + \left[\frac{1}{4} + \frac{1}{100}\right] + \dots + \left[\frac{1}{4} + \frac{199}{200}\right]$  is  
 (a) 49                      (b) 50                      (c) 51                      (d) None of these
30. The value of  $x = \sqrt{2 + \sqrt{2 + \sqrt{2 + \dots}}}$  is [Karnataka CET 2001]  
 (a) -1                      (b) 1                      (c) 2                      (d) 3
31. If  $x^2 - x + 1 = 0$ , then value of  $x^{3n}$  is [DCE 1995]  
 (a) -1, 1                      (b) 1                      (c) -1                      (d) 0
32. For what value of  $a$  the curve  $y = x^2 + ax + 25$  touches the  $x$ -axis  
 (a) 0                      (b)  $\pm 5$                       (c)  $\pm 10$                       (d) None of these
33. Let  $\alpha, \beta$  be the roots of the quadratic equation  $x^2 + px + p^3 = 0$  ( $p \neq 0$ ). If  $(\alpha, \beta)$  is a point on the parabola  $y^2 = x$ , then the roots of the quadratic equation are [MP PET 2000]

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- (a) 4, - 2                      (b) - 4, - 2                      (c) 4, 2                      (d) - 4, 2
34. If expression  $e^{\{(\sin^2 x + \sin^4 x + \sin^6 x + \dots) \ln 2\}}$  satisfies the equation  $x^2 - 9x + 8 = 0$ , find the value of  $\frac{\cos x}{\cos x + \sin x}$ ,  $0 < x < \frac{\pi}{2}$  [IIT 199]
- (a)  $\frac{1}{1 + \sqrt{3}}$                       (b)  $\frac{1}{1 - \sqrt{3}}$                       (c)  $\frac{2}{1 - \sqrt{2}}$                       (d) None of these
35. The roots of equation  $\frac{2x + 31}{9} + \frac{x^2 + 7}{x^2 - 7} = \frac{2x + 47}{9}$  are [Rajasthan PET 1994]
- (a) 3, - 3                      (b) 5, - 5                      (c)  $\sqrt{3}, -\sqrt{3}$                       (d)  $\sqrt{5}, -\sqrt{5}$
36. If  $x^2 + y^2 = 25, xy = 12$ , then  $x =$  [BIT Ranchi 1992]
- (a) {3, 4}                      (b) {3, - 3}                      (c) {3, 4, - 3, - 4}                      (d) {- 3, - 3}
37. The sum of all real roots of the equation  $|x - 2|^2 + |x - 2| - 2 = 0$  is [IIT 1997; Himachal CET 2002]
- (a) 2                      (b) 4                      (c) 1                      (d) None of these
38. A two digit number is four times the sum and three times the product of its digits. The number is [MP PET 1994]
- (a) 42                      (b) 24                      (c) 12                      (d) 21
39. The number of real solutions of the equation  $|x^2 + 4x + 3| + 2x + 5 = 0$  are [IIT 1988]
- (a) 1                      (b) 2                      (c) 3                      (d) 4
40. The number of the real values of  $x$  for which the equality  $|3x^2 + 12x + 6| = 5x + 16$  holds good is [AMU 1999]
- (a) 4                      (b) 3                      (c) 2                      (d) 1
41. The number of real solutions of the equation  $\sin e^x = 5^x + 5^{-x}$  is [IIT 1990, 2002]
- (a) 0                      (b) 1                      (c) 2                      (d) Infinitely many
42. The number of the real solutions of the equation  $-x^2 + x - 1 = \sin^4 x$  is
- (a) 1                      (b) 2                      (c) 0                      (d) 4
43. The number of solutions of  $\cos x = \frac{|x|}{80}$  is
- (a) 50                      (b) 52                      (c) 53                      (d) None of these
44. The equation  $\sqrt{(x+1)} - \sqrt{(x-1)} = \sqrt{(4x-1)}$  has [IIT 1997]
- (a) No solution                      (b) One solution                      (c) Two solutions                      (d) More than two solution
45. The number of real roots of  $\sqrt{5x^2 - 6x + 8} - \sqrt{5x^2 - 6x - 7} = 1$  is [Roorkee 1984]
- (a) 1                      (b) 2                      (c) 3                      (d) 4
46. The number of roots of the quadratic equation  $8 \sec^2 \theta - 6 \sec \theta + 1 = 0$  is [Pb. CET 1989,94]
- (a) Infinite                      (b) 1                      (c) 2                      (d) 0
47. The number of values of  $x$  in the interval  $[0, 5\pi]$  satisfying the equation  $3 \sin^2 x - 7 \sin x + 2 = 0$  is [IIT 1998, MP PET 2000]
- (a) 0                      (b) 5                      (c) 6                      (d) 10
48. The maximum number of real roots of the equation  $x^{2n} - 1 = 0$ , is [MP PET 2001]
- (a) 2                      (b) 3                      (c)  $n$                       (d)  $2n$
49. The equation  $x + \frac{2}{1-x} = 1 + \frac{2}{1-x}$ , has [IIT 1983; MNR 1998; Kurukshetra CEE 1993]
- (a) No real root                      (b) One real root                      (c) Two equal roots                      (d) Infinitely many roots
50. The number of real roots of equation  $(x-1)^2 + (x-2)^2 + (x-3)^2 = 0$  is [IIT 1990; Karnataka CET 1998]
- (a) 2                      (b) 1                      (c) 0                      (d) 3
51. The number of roots of the equation  $\log(-2x) = 2 \log(x+1)$  are [AMU 2001]
- (a) 3                      (b) 2                      (c) 1                      (d) None of these
52. Number of real roots of the equation  $\sum_{r=1}^{10} (x-r)^3 = 0$  is
- (a) 0                      (b) 1                      (c) 2                      (d) 3
53. The minimum value of  $|x-3| + |x-2| + |x-5|$  is
- (a) 3                      (b) 7                      (c) 5                      (d) 9

54. Rationalised denominator of  $\frac{1}{\sqrt{2} + \sqrt{3} + \sqrt{5}}$  is  
 (a)  $\frac{2\sqrt{3} + 3\sqrt{2} - \sqrt{30}}{12}$  (b)  $\frac{3\sqrt{2} - 2\sqrt{3} - \sqrt{30}}{15}$  (c)  $\frac{2\sqrt{3} - 3\sqrt{2} + \sqrt{40}}{10}$  (d)  $\frac{2\sqrt{3} + 3\sqrt{2} - \sqrt{20}}{15}$
55. If  $x = \sqrt{7 + 4\sqrt{3}}$ , then  $x + \frac{1}{x} =$  [EAMCET 1994]  
 (a) 4 (b) 6 (c) 3 (d) 2
56. If  $\log_2 x + \log_x 2 = \frac{10}{3} = \log_2 y + \log_y 2$  and  $x \neq y$ , then  $x + y =$  [EAMCET 1994]  
 (a) 2 (b)  $\frac{65}{8}$  (c)  $\frac{37}{6}$  (d) None of these
57. The equation  $\log_e x + \log_e(1+x) = 0$  can be written as [Kurukshetra CEE 1993; MP PET 1989]  
 (a)  $x^2 + x - e = 0$  (b)  $x^2 + x - 1 = 0$  (c)  $x^2 + x + 1 = 0$  (d)  $x^2 + xe - e = 0$
58. If  $f(x) = 2x^3 + mx^2 - 13x + n$  and 2, 3 are roots of the equation  $f(x) = 0$ , then the value of  $m$  and  $n$  are [Roorkee 1990]  
 (a) - 5, - 30 (b) - 5, 30 (c) 5, 30 (d) None of these
59. The number of real solutions of the equation  $e^x = x$  is  
 (a) 1 (b) 2 (c) 0 (d) None of these
60. The sum of the real roots of the equation  $x^2 + |x| - 6 = 0$  is  
 (a) 4 (b) 0 (c) - 1 (d) None of these
61. 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
62. The number of values of the pair  $(a, b)$  for which  $a(x+1)^2 + b(x^2 - 3x - 2) + x + 1 = 0$  is an identity in  $x$  is  
 (a) 0 (b) 1 (c) 2 (d) Infinite
63. If  $(\sqrt{2})^x + (\sqrt{3})^x = (\sqrt{13})^{x/2}$  then the number of values of  $x$  is  
 (a) 2 (b) 4 (c) 1 (d) None of these
64. The number of real solutions of the equation  $\frac{6-x}{x^2-4} = 2 + \frac{x}{x+2}$  is  
 (a) Two (b) One (c) Zero (d) None of these
65. The number of real solutions of  $\sqrt{x^2 - 4x + 3} + \sqrt{x^2 - 9} = \sqrt{4x^2 - 14x + 6}$  is  
 (a) One (b) Two (c) Three (d) None of these

**Advance Level**

66. If  $-1 \leq x < 0$ , then solution of the equation  $|x+1| - |x| + 3|x-1| - |x-2| = x+2$  is [IIT 1976]  
 (a) 1, 5/3 (b) 5/3 (c) 1/3 (d) None of these
67. The real roots of  $|x|^3 - 3x^2 + 3|x| - 2 = 0$  are [DCE 1997]  
 (a) 0, 2 (b)  $\pm 1$  (c)  $\pm 2$  (d) 1, 2
68. The number of real solutions of the equation  $2^{x/2} + (\sqrt{2} + 1)^x = (5 + 2\sqrt{2})^{x/2}$  is  
 (a) One (b) Two (c) Four (d) Infinite
69. The number of negative integral solutions of  $x^2 \cdot 2^{x+1} + 2^{x-3} + 2 = x^2 \cdot 2^{x-3+4} + 2^{x-1}$  is [DCE 1993]  
 (a) 0 (b) 1 (c) 2 (d) 4
70. The equation  $e^x - x - 1 = 0$  has [Kurukshetra CEE 1998]  
 (a) Only one real root  $x = 0$  (b) At least two real roots (c) Exactly two real roots (d)
71. The number of real roots of the equation  $e^{\sin x} - e^{-\sin x} - 4 = 0$  are [IIT 1982]  
 (a) 1 (b) 2 (c) Infinite (d) None of these
72. If  $a, b, c$  are positive real numbers, then the number of real roots of the equation  $ax^2 + b|x| + c = 0$  is [DCE 1998, UPSEAT 1999]

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- (a) 2 (b) 4 (c) 0 (d) None of these
73. The number of real solutions of equation  $\log_{10}[98 + \sqrt{x^3 - x^2 - 12x + 36}] = 2$  are  
 (a) 4 (b) 1 (c) 2 (d) 3
74. The equation  $x^{(3/4)(\log_2 x)^2 + (\log_2 x) - 5/4} = \sqrt{2}$  has [IIT 1989]  
 (a) At least one real solution (b) Exactly three real solutions  
 (c) Exactly one irrational solution (d) All the above
75. The number of solutions of  $|[x] - 2x| = 4$ , where  $[x]$  is the greatest integer  $\leq x$ , is  
 (a) 2 (b) 4 (c) 1 (d) Infinite
76. Let  $f(x)$  be a function defined by  $f(x) = x - [x]$ ,  $0 \neq x \in R$ , where  $[x]$  is the greatest integer less than or equal to  $x$ .  
 then the number of solutions of  $f(x) + f\left(\frac{1}{x}\right) = 1$   
 (a) 0 (b) Infinite (c) 1 (d) 2
77. If  $m$  be the number of integral solutions of equation  $2x^2 - 3xy - 9y^2 - 11 = 0$  and  $n$  be the number of real solutions  
 of equation  $x^3 - [x] - 3 = 0$ , then  $m =$   
 (a)  $n$  (b)  $2n$  (c)  $n/2$  (d)  $3n$
78. The set of values of  $c$  for which  $x^3 - 6x^2 + 9x - c$  is of the form  $(x - \alpha)^2(x - \beta)$  ( $\alpha, \beta$  real) is given by  
 (a)  $\{0\}$  (b)  $\{4\}$  (c)  $\{0, 4\}$  (d) Null set
79. If  $0 < a_r < 1$  for  $r = 1, 2, 3, \dots, k$  and  $m$  be the number of real solutions of equation  $\sum_{r=1}^k (a_r)^x = 1$  and  $n$  be the  
 number of real solution of equation  $\sum_{r=1}^k (x - a_r)^{101} = 0$ , then  
 (a)  $m = n$  (b)  $m \leq n$  (c)  $m \geq n$  (d)  $m > n$
80. Let  $P_n(x) = 1 + 2x + 3x^2 + \dots + (n+1)x^n$  be a polynomial such that  $n$  is even. Then the number of real roots of  
 $P_n(x) = 0$  is [DCE 1994]  
 (a) 0 (b)  $n$  (c) 1 (d) None of these
81. The number of all possible triplets  $(a_1, a_2, a_3)$  such that  $a_1 + a_2 \cos 2x + a_3 \sin^2 x = 0$  for all  $x$  is [IIT 1987]  
 (a) Zero (b) One (c) Three (d) Infinite
82. The solutions of the equation  $2x - 2[x] = 1$ , where  $[x]$  = the greatest integer less than or equal to  $x$ , are  
 (a)  $x = n + \frac{1}{2}, n \in N$  (b)  $x = n - \frac{1}{2}, n \in N$  (c)  $x = n + \frac{1}{2}, n \in Z$  (d)  $n < x < n+1, n \in Z$
83. The number of real solutions of  $1 + |e^x - 1| = e^x(e^x - 2)$  is  
 (a) 0 (b) 1 (c) 2 (d) 4
84. The equation  $2 \sin^2 \frac{x}{2} \cdot \cos^2 x = x + \frac{1}{x}, 0 < x \leq \frac{\pi}{2}$  has  
 (a) One real solution (b) No real solution  
 (c) Infinitely many real solutions (d) None of these
85. If  $y \neq 0$  then the number of values of the pair  $(x, y)$  such that  $x + y + \frac{x}{y} = \frac{1}{2}$  and  $(x + y) \frac{x}{y} = -\frac{1}{2}$ , is  
 (a) 1 (b) 2 (c) 0 (d) None of these
86. The number of real solutions of the equation  $\log_{0.5} x = |x|$  is  
 (a) 1 (b) 2 (c) 0 (d) None of these
87. The product of all the solutions of the equation  $(x - 2)^2 - 3|x - 2| + 2 = 0$  is  
 (a) 2 (b) -4 (c) 0 (d) None of these

88. If  $0 < x < 1000$  and  $\left[\frac{x}{2}\right] + \left[\frac{x}{3}\right] + \left[\frac{x}{5}\right] = \frac{31}{30}x$ , where  $[x]$  is the greatest integer less than or equal to  $x$ , the number of possible values of  $x$  is  
 (a) 34 (b) 32 (c) 33 (d) None of these
89. The solution set of  $(x)^2 + (x+1)^2 = 25$ , where  $(x)$  is the least integer greater than or equal to  $x$ , is  
 (a) (2, 4) (b)  $(-5, -4] \cup (2, 3]$  (c)  $[-4, -3] \cup (3, 4]$  (d) None of these
90. If  $[x]^2 = [x+2]$ , where  $[x]$  = the greatest integer less than or equal to  $x$ , then  $x$  must be such that  
 (a)  $x = 2, -1$  (b)  $x \in [2, 3)$  (c)  $x \in [-1, 0)$  (d) None of these
91. The solution set of  $\left|\frac{x+1}{x}\right| + |x+1| = \frac{(x+1)^2}{|x|}$  is  
 (a)  $\{x \mid x \geq 0\}$  (b)  $\{x \mid x > 0\} \cup \{-1\}$  (c)  $\{-1, 1\}$  (d)  $\{x \mid x \geq 1 \text{ or } x \leq -1\}$
92. If  $a \cdot 3^{\tan x} + a \cdot 3^{-\tan x} - 2 = 0$  has real solutions,  $x \neq \frac{\pi}{2}, 0 \leq x \leq \pi$ , then the set of possible values of the parameter  $a$  is  
 (a)  $[-1, 1]$  (b)  $[-1, 0)$  (c)  $(0, 1]$  (d)  $(0, +\infty)$

Nature of roots

Basic Level

93. The roots of the quadratic equation  $2x^2 + 3x + 1 = 0$ , are [IIT 1983]  
 (a) Irrational (b) Rational (c) Imaginary (d) None of these
94. The roots of the equation  $x^2 + 2\sqrt{3}x + 3 = 0$  are [Rajasthan PET 1986]  
 (a) Real and equal (b) Rational and equal (c) Irrational and equal (d) Irrational and unequal
95. If  $l, m, n$  are real and  $l \neq m$ , then the roots of the equation  $(l-m)x^2 - 5(l+m)x - 2(l-m) = 0$  are [IIT 1979; Rajasthan PET 1983]  
 (a) Complex (b) Real and distinct (c) Real and equal (d) None of these
96. If  $a$  and  $b$  are the odd integers, then the roots of the equation  $2ax^2 + (2a+b)x + b = 0, a \neq 0$ , will be [Pb. CET 1988]  
 (a) Rational (b) Irrational (c) Non-real (d) Equal
97. If  $k \in (-\infty, -2) \cup (2, \infty)$ , then the roots of the equation  $x^2 + 2kx + 4 = 0$  are [DCE 2002]  
 (a) Complex (b) Real and unequal (c) Real and equal (d) One real and one imaginary
98. Let  $a, b$  and  $c$  be real numbers such that  $4a + 2b + c = 0$  and  $ab > 0$ . Then the quadratic equation  $ax^2 + bx + c = 0$  has [IIT 1990]  
 (a) Real roots (b) Complex roots (c) Purely imaginary roots (d) Only one root
99. If  $a < b < c < d$ , then the roots of the equation  $(x-a)(x-c) + 2(x-b)(x-d) = 0$  are [IIT 1984]  
 (a) Real and distinct (b) Real and equal (c) Imaginary (d) None of these
100. If  $b_1 b_2 = 2(c_1 + c_2)$ , then at least one of the equations  $x^2 + b_1 x + c_1 = 0$  and  $x^2 + b_2 x + c_2 = 0$  has  
 (a) Real roots (b) Purely imaginary roots (c) Imaginary roots (d) None of these
101. In the equation  $x^3 + 3Hx + G = 0$ , if  $G$  and  $H$  are real and  $G^2 + 4H^3 > 0$ , then the roots are [Karnataka CET 2000]  
 (a) All real and equal (b) All real and distinct (c) One real and two imaginary (d)
102. The equation  $(x-a)^3 + (x-b)^3 + (x-c)^3 = 0$ , has  
 (a) All the roots real (b) One real and two imaginary roots  
 (c) Three real roots namely  $x = a, x = b, x = c$  (d) None of these
103. For the equation  $|x^2| + |x| - 6 = 0$ , the roots are [EAMCET 1988, 93]  
 (a) One and only one real number (b) Real with sum one  
 (c) Real with sum zero (d) Real with product zero
104. If  $a > 0, b > 0, c > 0$ , then both the roots of the equation  $ax^2 + bx + c = 0$  [IIT 1980]  
 (a) Are real and negative (b) Have negative real parts (c) Are rational numbers (d) None of these

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105. Let one root of  $ax^2 + bx + c = 0$ , where  $a, b, c$  are integers be  $3 + \sqrt{5}$ , then the other root is [MNR 1982]  
 (a)  $3 - \sqrt{5}$  (b) 3 (c)  $\sqrt{5}$  (d) None of these
106. If  $2 + i$  is a root of the equation  $x^3 - 5x^2 + 9x - 5 = 0$ , then the other roots are [Kerala (Engg.) 2002]  
 (a) 1 and  $2 - i$  (b)  $-1$  and  $3 + i$  (c) 0 and 1 (d)  $-1$  and  $i - 2$
107. If  $a, b, c$  are nonzero, unequal rational numbers then the roots of the equation  $abc^2x^2 + (3a^2 + b^2)cx - 6a^2 - ab + 2b^2 = 0$  are  
 (a) Rational (b) Imaginary (c) Irrational (d) None of these
108. The equation  $x^2 - 6x + 8 + \lambda(x^2 - 4x + 3) = 0$ ,  $\lambda \in R$ , has  
 (a) Real and unequal roots for all  $\lambda$  (b) Real roots for  $\lambda < 0$  only  
 (c) Real roots for  $\lambda > 0$  only (d) Real and unequal roots for  $\lambda = 0$  only
109. If  $a > 1$ , 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 nonreal complex
110. If the roots of the equation  $ax^2 + x + b = 0$  be real, then the roots of the equation  $x^2 - 4\sqrt{ab}x + 1 = 0$  will be  
 (a) Rational (b) Irrational (c) Real (d) Imaginary
111. If the roots of the equation  $x^2 - 8x + (a^2 - 6a) = 0$  are real, then [Rajasthan PET 1987, 97]  
 (a)  $-2 < a < 8$  (b)  $2 < a < 8$  (c)  $-2 \leq a \leq 8$  (d)  $2 \leq a \leq 8$
112. If the roots of the given equation  $(\cos p - 1)x^2 + (\cos p)x + \sin p = 0$  are real, then [IIT 1990; Rajasthan PET 1995]  
 (a)  $p \in (-\pi, 0)$  (b)  $p \in \left(-\frac{\pi}{2}, \frac{\pi}{2}\right)$  (c)  $p \in (0, \pi)$  (d)  $p \in (0, 2\pi)$
113. The greatest value of a non-negative real number  $\lambda$  for which both the equations  $2x^2 + (\lambda - 1)x + 8 = 0$  and  $x^2 - 8x + \lambda + 4 = 0$  have real roots is [AMU 1990]  
 (a) 9 (b) 12 (c) 15 (d) 16
114. If  $p, q, r$  are positive and are in A.P., then roots of the equation  $px^2 + qx + r = 0$  are real if [IIT 1995]  
 (a)  $\left|\frac{r}{p} - 7\right| \geq 4\sqrt{3}$  (b)  $\left|\frac{p}{r} - 7\right| \geq 4\sqrt{3}$  (c) For all values of  $p, r$  (d) For no value of  $p, r$
115. Let  $p, q \in \{1, 2, 3, 4\}$ . The number of equations of the form  $px^2 + qx + 1 = 0$  having real roots is [IIT 1994]  
 (a) 15 (b) 9 (c) 7 (d) 8
116. The least integer  $k$  which makes the roots of the equation  $x^2 + 5x + k = 0$  imaginary is [Kerala (Engg.) 2002]  
 (a) 4 (b) 5 (c) 6 (d) 7
117. If  $0 < a < b < c$ , and the roots  $\alpha, \beta$  of the equation  $ax^2 + bx + c = 0$  are non-real complex numbers, then  
 (a)  $|\alpha| = |\beta|$  (b)  $|\alpha| > 1$  (c)  $|\beta| < 1$  (d) None of these
118. If roots of the equation  $a(b - c)x^2 + b(c - a)x + c(a - b) = 0$  are equal, then  $a, b, c$  are in [Roorkee 1993; Rajasthan PET 2001]  
 (a) A.P. (b) G.P. (c) H.P. (d) None of these
119. If the equation  $(m - n)x^2 + (n - l)x + l - m = 0$  has equal roots, then  $l, m$  and  $n$  satisfy [DCE 2002; EAMCET 1990]  
 (a)  $2l = m + n$  (b)  $2m = n + l$  (c)  $m = n + l$  (d)  $l = m + n$
120. The condition for the roots of the equation  $(c^2 - ab)x^2 - 2(a^2 - bc)x + (b^2 - ac) = 0$  to be equal is [TS Rajendra 1982]  
 (a)  $a = 0$  (b)  $b = 0$  (c)  $c = 0$  (d) None of these
121. If the roots of the equation  $(a^2 + b^2)t^2 - 2(ac + bd)t + (c^2 + d^2) = 0$  are equal, then [MP PET 1996]  
 (a)  $ab = dc$  (b)  $ac = bd$  (c)  $ad + bc = 0$  (d)  $\frac{a}{b} = \frac{c}{d}$
122. If one root of  $x^2 + px + 12 = 0$  is 4 and roots of the equation  $x^2 + px + q = 0$  are equal, then  $q$  is equal to [Rajasthan PET 1990]  
 (a)  $49/4$  (b)  $4/49$  (c) 4 (d) None of these
123. If the roots of the equation  $x^2 + 2mx + m^2 - 2m + 6 = 0$  are same, then the value of  $m$  will be [MP PET 1986]

- (a) 3                                      (b) 0                                      (c) 2                                      (d) -1
- 124.** If the roots of the equation  $x^2 - 15 - m(2x - 8) = 0$  are equal then  $m$  is equal to [Rajasthan PET 1985]  
 (a) 3, - 5                                      (b) - 3, 5                                      (c) 3, 5                                      (d) - 3, - 5
- 125.** For what value of  $k$  will the equation  $x^2 - (3k - 1)x + 2k^2 - 11 = 0$  have equal roots [Karnataka CET 1998]  
 (a) 5                                      (b) 9                                      (c) Both the above                                      (d) 0
- 126.** The value of  $k$  for which the quadratic equation  $kx^2 + 1 = kx + 3x - 11x^2 = 0$  has real and equal roots are [BIT Ranchi 1993]  
 (a) -11, - 3                                      (b) 5, 7                                      (c) 5, -7                                      (d) None of these
- 127.** If the roots of  $4x^2 + px + 9 = 0$  are equal, then absolute value of  $p$  is [MP PET 1995]  
 (a) 144                                      (b) 12                                      (c) - 12                                      (d)  $\pm 12$
- 128.** The value of  $k$  for which  $2x^2 - kx + x + 8 = 0$  has equal and real roots are [BIT Ranchi 1990]  
 (a) - 9 and - 7                                      (b) 9 and 7                                      (c) - 9 and 7                                      (d) 9 and - 7
- 129.** The roots of  $4x^2 + 6px + 1 = 0$  are equal, then the value of  $p$  is [MP PET 2003]  
 (a)  $\frac{4}{5}$                                       (b)  $\frac{1}{3}$                                       (c)  $\frac{2}{3}$                                       (d)  $\frac{4}{3}$
- 130.** If the equation  $x^2 - (2 + m)x + (m^2 - 4m + 4) = 0$  has coincident roots, then [Roorkee 1991]  
 (a)  $m = 0, m = 1$                                       (b)  $m = 0, m = 2$                                       (c)  $m = \frac{2}{3}, m = 6$                                       (d)  $m = \frac{2}{3}, m = 1$
- 131.** If two roots of the equation  $x^3 - 3x + 2 = 0$  are same, then the roots will be [MP PET 1985]  
 (a) 2, 2, 3                                      (b) 1, 1, - 2                                      (c) - 2, 3, 3                                      (d) - 2, - 2, 1
- 132.** The equation  $\|x - 1| + a| = 4$  can have real solutions for  $x$  if  $a$  belongs to the interval  
 (a)  $(-\infty, 4]$                                       (b)  $(-\infty, - 4]$                                       (c)  $(4, \infty)$                                       (d)  $[- 4, 4]$
- 133.** 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 [AMU 1992]  
 (a)  $-3 < m \leq -1$                                       (b)  $-4 < m \leq -3$                                       (c)  $-3 \leq m \leq 5$                                       (d)  $-3 \geq m$  or  $m \geq 5$
- 134.** Both the roots of the given equation  $(x - a)(x - b) + (x - b)(x - c) + (x - c)(x - a) = 0$  are always [MNR 1986; IIT 1980; Kurukshetra CEE 1998]  
 (a) Positive                                      (b) Negative                                      (c) Real                                      (d) Imaginary
- 135.** If  $P(x) = ax^2 + bx + c$  and  $Q(x) = -ax^2 + dx + c$  where  $ac \neq 0$ , then  $P(x) \cdot Q(x) = 0$ , has at least [IIT 1985]  
 (a) Four real roots                                      (b) Two real roots                                      (c) Four imaginary roots                                      (d) None of these
- 136.** The conditions that the equation  $ax^2 + bx + c = 0$  has both the roots positive is that [SCRA 1990]  
 (a)  $a, b$  and  $c$  are of the same sign                                      (b)  $a$  and  $b$  are of the same sign  
 (c)  $b$  and  $c$  have the same sign opposite to that of  $a$                                       (d)  $a$  and  $c$  have the same sign opposite to that of  $b$
- 137.** If  $[x]$  denotes the integral part of  $x$  and  $k = \sin^{-1} \frac{1 + t^2}{2t} > 0$ , then the integral value of  $\alpha$  for which the equation  $(x - [k])(x + \alpha) - 1 = 0$  has integral roots is  
 (a) 1                                      (b) 2                                      (c) 4                                      (d) None of these
- 138.** If the roots of the equation  $ax^2 + bx + c = 0$  are real and of the form  $\frac{\alpha}{\alpha - 1}$  and  $\frac{\alpha + 1}{\alpha}$ , then the value of  $(a + b + c)^2$  is [AMU 2000]  
 (a)  $b^2 - 4ac$                                       (b)  $b^2 - 2ac$                                       (c)  $2b^2 - ac$                                       (d) None of these



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139. Equation  $\frac{a^2}{x-\alpha} + \frac{b^2}{x-\beta} + \frac{c^2}{x-\gamma} = m - n^2x$  ( $a, b, c, m, n \in R$ ) has necessarily
- (a) All the roots real (b) All the roots imaginary  
(c) Two real and two imaginary roots (d) Two rational and two irrational roots
140. If  $\cos \theta, \sin \phi, \sin \theta$  are in G.P. then roots of  $x^2 + 2 \cot \phi x + 1 = 0$  are always
- (a) Equal (b) Real (c) Imaginary (d) Greater than 1
141. If  $f(x)$  is a continuous function and attains only rational values and  $f(0) = 3$ , then roots of equation  $f(1)x^2 + f(3)x + f(5) = 0$  are
- (a) Imaginary (b) Rational (c) Irrational (d) Real and equal
142. The roots of  $ax^2 + bx + c = 0$ , where  $a \neq 0$  and coefficients are real, are non-real complex and  $a + c < b$ . Then
- (a)  $4a + c > 2b$  (b)  $4a + c < 2b$  (c)  $4a + c = 2b$  (d) None of these
143. The equation  $(a+2)x^2 + (a-3)x = 2a-1, a \neq -2$  has roots rational for
- (a) All rational values of  $a$  except  $a = -2$  (b) All real values of  $a$  except  $a = -2$   
(c) Rational values of  $a > \frac{1}{2}$  (d) None of these
144. The quadratic equation  $x^2 - 2x - \lambda = 0, \lambda \neq 0$
- (a) Cannot have a real root if  $\lambda < 1$   
(b) Can have a rational root if  $\lambda$  is a perfect square  
(c) Cannot have an integral root if  $n^2 - 1 < \lambda < n^2 + 2n$  where  $n = 0, 1, 2, 3, \dots$   
(d) None of these
145. If the roots of the equation  $x^2 + px + q = 0$  are  $\alpha$  and  $\beta$  and roots of the equation  $x^2 - xr + s = 0$  are  $\alpha^4, \beta^4$ , then the roots of the equation  $x^2 - 4qx + 2q^2 - r = 0$  will be [IIT 1989]
- (a) Both negative (b) Both positive  
(c) Both real (d) One negative and one positive
146. If equation  $a(b-c)x^2 + b(c-a)x + c(a-b) = 0$  has equal roots,  $a, b, c > 0, n \in N$ , then
- (a)  $a^n + c^n \geq 2b^n$  (b)  $a^n + c^n > 2b^n$  (c)  $a^n + c^n \leq 2b^n$  (d)  $a^n + c^n < 2b^n$
147. If  $\frac{\sum_{r=0}^{k-1} x^{2r}}{\sum_{r=0}^{k-1} x^r}$  is a polynomial in  $x$  for two values of  $p$  and  $q$  of  $k$ , then roots of equation  $x^2 + px + q = 0$  cannot be
- (a) Real (b) Imaginary (c) Rational (d) Irrational
148. If for  $x > 0$ ,  $f(x) = (a - x^n)^{1/n}$ ,  $g(x) = x^2 + px + q, p, q \in R$  and equation  $g(x) - x = 0$  has imaginary roots, then number of real roots of equation  $g(g(x)) - f(f(x)) = 0$  is
- (a) 0 (b) 2 (c) 4 (d) None of these
149. Let  $p, q \in \{1, 2, 3, 4\}$ . The number of equations of the form  $px^2 + qx + 1 = 0$  having real and unequal roots is
- (a) 15 (b) 9 (c) 7 (d) 8
150. If  $\alpha_1, \alpha_2$  and  $\beta_1, \beta_2$  are the roots of the equations  $ax^2 + bx + c = 0$  and  $px^2 + qx + r = 0$  respectively and system of equations  $\alpha_1 y + \alpha_2 z = 0$  and  $\beta_1 y + \beta_2 z = 0$  has a non-zero solution. Then [IIT 1987]
- (a)  $a^2qc = p^2br$  (b)  $p^2br = q^2ac$  (c)  $c^2ar = r^2pb$  (d) None of these
151. If  $a, b, c, d$  are four consecutive terms of an increasing AP then the roots of the equation  $(x-a)(x-c) + 2(x-b)(x-d) = 0$  are
- (a) Real and distinct (b) Nonreal complex (c) Real and equal (d) Integers
152. If  $a, b, c$  are three distinct positive real numbers then the number of real roots of  $ax^2 + 2b|x| - c = 0$  is



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167. If  $\alpha, \beta$  are the roots of the equation  $x^2 - p(x+1) - c = 0$ , then  $(\alpha+1)(\beta+1) =$  [BITS Ranchi 2000; Him. CET 2001]  
 (a)  $c$  (b)  $c - 1$  (c)  $1 - c$  (d) None of these
168. If  $\alpha, \beta, \gamma$  are the roots of the equation  $x^3 + 4x + 1 = 0$ , then  $(\alpha + \beta)^{-1} + (\beta + \gamma)^{-1} + (\gamma + \alpha)^{-1} =$  [EAMCET 2003]  
 (a) 2 (b) 3 (c) 4 (d) 5
169. If roots of  $x^2 - 7x + 6 = 0$  are  $\alpha, \beta$  then  $\frac{1}{\alpha} + \frac{1}{\beta} =$  [Rajasthan PET 1990, 95; MNR 1981]  
 (a)  $6/7$  (b)  $7/6$  (c)  $7/10$  (d)  $8/9$
170. If  $\alpha, \beta$  are the roots of  $x^2 - 2x + 4 = 0$ , then  $\alpha^5 + \beta^5$  is equal to [EAMCET 1990]  
 (a) 16 (b) 32 (c) 64 (d) None of these
171. If the roots of the equation  $ax^2 + bx + c = 0$  are  $\alpha, \beta$ , then the value of  $\alpha\beta^2 + \alpha^2\beta + \alpha$  will be [EAMCET 1980; AMU 1984]  
 (a)  $\frac{c(a-b)}{a^2}$  (b) 0 (c)  $-\frac{bc}{a^2}$  (d) None of these
172. If  $\alpha, \beta$  be the roots of the equation  $2x^2 - 35x + 2 = 0$ , then the value of  $(2\alpha - 35)^3 \cdot (2\beta - 35)^3$  is equal to [Bihar CEE 1994]  
 (a) 1 (b) 64 (c) 8 (d) None of these
173. If  $\alpha$  and  $\beta$  are roots of  $ax^2 + 2bx + c = 0$ , then  $\sqrt{\frac{\alpha}{\beta}} + \sqrt{\frac{\beta}{\alpha}}$  is equal to [BITS Ranchi 1990]  
 (a)  $\frac{2b}{ac}$  (b)  $\frac{2b}{\sqrt{ac}}$  (c)  $-\frac{2b}{\sqrt{ac}}$  (d)  $-\frac{b}{\sqrt{2}}$
174. If  $\alpha, \beta$  are the roots of the equation  $x^2 + 2x + 4 = 0$ , then  $\frac{1}{\alpha^3} + \frac{1}{\beta^3}$  is equal to [Kerala (Engg.) 2002]  
 (a)  $-\frac{1}{2}$  (b)  $\frac{1}{2}$  (c) 32 (d)  $\frac{1}{4}$
175. If  $\alpha, \beta, \gamma$  are roots of equation  $x^3 + ax^2 + bx + c = 0$ , then  $\alpha^{-1} + \beta^{-1} + \gamma^{-1} =$  [EAMCET 2002]  
 (a)  $a/c$  (b)  $-b/c$  (c)  $b/a$  (d)  $c/a$
176. If  $\alpha, \beta$  are roots of  $x^2 - 3x + 1 = 0$ , then the value of  $\alpha^3 + \beta^3$  is [MP 1994; BIT Ranchi 1990]  
 (a) 9 (b) 18 (c) -9 (d) -18
177. If A.M. of the roots of a quadratic equation is  $8/5$  and A.M. of their reciprocals is  $8/7$ , then the equation is [AMU 2001]  
 (a)  $5x^2 - 16x + 7 = 0$  (b)  $7x^2 - 16x + 5 = 0$  (c)  $7x^2 - 16x + 8 = 0$  (d)  $3x^2 - 12x + 7 = 0$
178. The quadratic in  $t$ , such that A.M. of its roots is  $A$  and G.M. is  $G$ , is [IIT 1968, 74]  
 (a)  $t^2 - 2At + G^2 = 0$  (b)  $t^2 - 2At - G^2 = 0$  (c)  $t^2 + 2At + G^2 = 0$  (d) None of these
179. In a triangle  $ABC$ , the value of  $\angle A$  is given by  $5 \cos A + 3 = 0$ , then the equation whose roots are  $\sin A$  and  $\tan A$  will be [Roorkee 1972]  
 (a)  $15x^3 - 8x + 16 = 0$  (b)  $15x^2 + 8x - 16 = 0$  (c)  $15x^2 - 8\sqrt{2}x + 16 = 0$  (d)  $15x^2 - 8x - 16 = 0$
180. If  $x^2 + px + q = 0$  is the quadratic whose roots are  $a-2$  and  $b-2$  where  $a$  and  $b$  are the roots of  $x^2 - 3x + 1 = 0$ , then [Kerala (Engg.) 2002]  
 (a)  $p = 1, q = 5$  (b)  $p = 1, q = -5$  (c)  $p = -1, q = 1$  (d) None of these
181. The roots of the equation  $x^2 + ax + b = 0$  are  $p$  and  $q$ , then the equation whose roots are  $p^2q$  and  $pq^2$  will be [MP PET 198]  
 (a)  $x^2 + abx + b^3 = 0$  (b)  $x^2 - abx + b^3 = 0$  (c)  $bx^2 + x + a = 0$  (d)  $x^2 + ax + ab = 0$
182. The equation whose roots are  $\frac{1}{3 + \sqrt{2}}$  and  $\frac{1}{3 - \sqrt{2}}$  is [MP PET 1994]  
 (a)  $7x^2 - 6x + 1 = 0$  (b)  $6x^2 - 7x + 1 = 0$  (c)  $x^2 - 6x + 7 = 0$  (d)  $x^2 - 7x + 6 = 0$
183. If  $\alpha, \beta$  are the roots of the equation  $lx^2 + mx + n = 0$  then the equation whose roots are  $\alpha^3\beta$  and  $\alpha\beta^3$  is [MP PET 1997]  
 (a)  $l^4x^2 - nl(m^2 - 2nl)x + n^4 = 0$  (b)  $l^4x^2 + nl(m^2 - 2nl)x + n^4 = 0$   
 (c)  $l^4x^2 + nl(m^2 - 2nl)x - n^4 = 0$  (d)  $l^4x^2 - nl(m^2 + 2nl)x + n^4 = 0$

184. If  $\alpha, \beta$  are the roots of  $9x^2 + 6x + 1 = 0$ , then the equation with the roots  $\frac{1}{\alpha}, \frac{1}{\beta}$  is [EAMCET 2000]
- (a)  $2x^2 + 3x + 18 = 0$       (b)  $x^2 + 6x - 9 = 0$       (c)  $x^2 + 6x + 9 = 0$       (d)  $x^2 - 6x + 9 = 0$
185. If  $\alpha, \beta$  are the roots of the equation  $ax^2 + bx + c = 0$ , then the equation whose roots are  $\alpha + \frac{1}{\beta}$  and  $\beta + \frac{1}{\alpha}$ , is [Rajasthan PE]
- (a)  $acx^2 + (a+c)bx + (a+c)^2 = 0$       (b)  $abx^2 + (a+c)bx + (a+c)^2 = 0$   
 (c)  $acx^2 + (a+b)cx + (a+c)^2 = 0$       (d) None of these
186. If  $\alpha, \beta$  are the roots of  $x^2 - 3x + 1 = 0$ , then the equation whose roots are  $\frac{1}{\alpha-2}, \frac{1}{\beta-2}$  is [Rajasthan PET 1999]
- (a)  $x^2 + x - 1 = 0$       (b)  $x^2 + x + 1 = 0$       (c)  $x^2 - x - 1 = 0$       (d) None of these
187. If  $\alpha, \beta$  are the roots of  $ax^2 + bx + c = 0$ , then the equation whose roots are  $2 + \alpha, 2 + \beta$  is [EAMCET 1994]
- (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)  $ax^2 + x(b-4a) + 4a - 2b + c = 0$
188. If  $\alpha, \beta$  are the roots of the equation  $ax^2 + bx + c = 0$ , then the equation with roots  $1/\alpha, 1/\beta$  will be [MNR 1988; SCRA 1990; Rajasthan PET 1994]
- (a)  $cx^2 - bx + a = 0$       (b)  $cx^2 + bx + a = 0$       (c)  $x^2 + bx + a = 0$       (d)  $x^2 + bx - a = 0$
189. Let  $\alpha, \alpha^2$  be the roots of  $x^2 + x + 1 = 0$ , then the equation whose roots are  $\alpha^{31}, \alpha^{62}$  is [AMU 1999]
- (a)  $x^2 - x + 1 = 0$       (b)  $x^2 + x - 1 = 0$       (c)  $x^2 + x + 1 = 0$       (d)  $x^{60} + x^{30} + 1 = 0$
190. If  $\alpha, \beta$  are roots of the equation  $x^2 - 2x \cos 2\theta + 1 = 0$  then the equation with roots  $\alpha^{n/2}, \beta^{n/2}$  will be [Rajasthan PET 1998]
- (a)  $x^2 - 2nx \cos \theta + 1 = 0$       (b)  $x^2 + 2nx \cos n\theta + 1 = 0$       (c)  $x^2 + 2x \cos n\theta + 1 = 0$       (d)  $x^2 - 2x \cos n\theta + 1 = 0$
191. The equation whose roots are reciprocal of the roots of the equation  $3x^2 - 20x + 17 = 0$  is [DCE 2002]
- (a)  $3x^2 + 20x - 17 = 0$       (b)  $17x^2 - 20x + 3 = 0$       (c)  $17x^2 + 20x + 3 = 0$       (d) None of these
192. The sum of the roots of a equation is 2 and sum of their cubes is 98, then the equation is [MP PET 1986]
- (a)  $x^2 + 2x + 15 = 0$       (b)  $x^2 + 15x + 2 = 0$       (c)  $2x^2 - 2x + 15 = 0$       (d)  $x^2 - 2x - 15 = 0$
193. Sum of roots is -1 and sum of their reciprocals is  $\frac{1}{6}$ , then equation is [Karnataka CET 1998]
- (a)  $x^2 + x - 6 = 0$       (b)  $x^2 - x + 6 = 0$       (c)  $x^2 + x + 1 = 0$       (d)  $x^2 - 6x + 1 = 0$
194. If  $\alpha, \beta$  are the roots of the quadratic equation  $x^2 + bx - c = 0$ , then the equation whose roots are  $b$  and  $c$  is [Pb. CET 1989]
- (a)  $x^2 + \alpha x - \beta = 0$       (b)  $x^2 - [(\alpha + \beta) + \alpha\beta]x - \alpha\beta(\alpha + \beta) = 0$   
 (c)  $x^2 + [(\alpha + \beta) + \alpha\beta]x + \alpha\beta(\alpha + \beta) = 0$       (d)  $x^2 + [\alpha\beta + (\alpha + \beta)]x - \alpha\beta(\alpha + \beta) = 0$
195. If  $\alpha, \beta$  are roots of  $x^2 - 5x - 3 = 0$ , then the equation with roots  $\frac{1}{2\alpha-3}$  and  $\frac{1}{2\beta-3}$  is [Rajasthan PET 1998]
- (a)  $33x^2 + 4x - 1 = 0$       (b)  $33x^2 - 4x + 1 = 0$       (c)  $33x^2 - 4x - 1 = 0$       (d)  $33x^2 + 4x + 1 = 0$
196. Given that  $\tan\alpha$  and  $\tan\beta$  are the roots of  $x^2 - px + q = 0$ , then the value of  $\sin^2(\alpha + \beta) =$  [Rajasthan PET 2000]
- (a)  $\frac{p^2}{p^2 + (1-q)^2}$       (b)  $\frac{p^2}{p^2 + q^2}$       (c)  $\frac{q^2}{p^2 + (1-q)^2}$       (d)  $\frac{p^2}{(p+q)^2}$
197. If  $2 + i\sqrt{3}$  is a root of the equation  $x^2 + px + q = 0$ , then  $(p, q)$  is equal to [IIT 1982; MP 1997]
- (a)  $(7, -4)$       (b)  $(-4, 7)$       (c)  $(4, 7)$       (d)  $(7, 4)$
198. In the equation  $x^2 + px + q = 0$ , the coefficient of  $x$  was taken as 17 in place of 13 and its roots were found to be -2 and -15. The correct roots of the original equation are [Rajasthan PET 1994; IIT 1979]
- (a) -10, -3      (b) 10, 3      (c) -10, 3      (d) 10, -3
199. Two students while solving a quadratic equation in  $x$ , one copied the constant term incorrectly and got the roots 3 and 2. The other copied the constant term and coefficient of  $x^2$  correctly as -6 and 1 respectively. The correct roots are [EAAMCET 1991]

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- (a) 3, -2                      (b) -3, 2                      (c) -6, -1                      (d) 6, -1
- 200.** 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 [EAMCI  
(a) 8, -1                      (b) -9, 2                      (c) -8, -2                      (d) 9, 1
- 201.** The equation formed by decreasing each root of  $ax^2 + bx + c = 0$  by 1 is  $2x^2 + 8x + 2 = 0$ , then [EAMCET 2000]  
(a)  $a = -b$                       (b)  $b = -c$                       (c)  $c = -a$                       (d)  $b = a + c$
- 202.** If  $p$  and  $q$  are non-zero constants, the equation  $x^2 + px + q = 0$  has roots  $u$  and  $v$ , then the equation  $qx^2 + px + 1 = 0$  has roots [MNR 1988]  
(a)  $u$  and  $\frac{1}{v}$                       (b)  $\frac{1}{u}$  and  $v$                       (c)  $\frac{1}{u}$  and  $\frac{1}{v}$                       (d) None of these
- 203.** If the sum of the roots of the equation  $x^2 + px + q = 0$  is equal to the sum of their squares, then [Pb. CET 1999]  
(a)  $p^2 - q^2 = 0$                       (b)  $p^2 + q^2 = 2q$                       (c)  $p^2 + p = 2q$                       (d) None of these
- 204.** If the sum of the roots of the equation  $x^2 + px + q = 0$  is three times their difference, then which one of the following is true [Dhanbad Engg. 1968]  
(a)  $9p^2 = 2q$                       (b)  $2q^2 = 9p$                       (c)  $2p^2 = 9q$                       (d)  $9q^2 = 2p$
- 205.** If the sum of the roots of the quadratic equation  $ax^2 + bx + c = 0$  is equal to the sum of the squares of their reciprocals, then  $\frac{b^2}{ac} + \frac{bc}{a^2} =$  [BITS Ranchi 1996]  
(a) 2                      (b) -2                      (c) 1                      (d) -1
- 206.** If the sum of the two roots of the equation  $4x^3 + 16x^2 - 9x - 36 = 0$  is zero, then the roots are [MP PET 1986]  
(a) 1, 2, -2                      (b)  $-2, \frac{2}{3}, -\frac{2}{3}$                       (c)  $-3, \frac{3}{2}, -\frac{3}{2}$                       (d)  $-4, \frac{3}{2}, -\frac{3}{2}$
- 207.** If the roots of the equation  $ax^2 + bx + c = 0$  are  $l$  and  $2l$ , then [MP PET 1986]  
(a)  $b^2 = 9ac$                       (b)  $2b^2 = 9ac$                       (c)  $b^2 = -4ac$                       (d)  $a^2 = c^2$
- 208.** If  $\alpha, \beta$  are the roots of the equation  $x^2 - px + 36 = 0$  and  $\alpha^2 + \beta^2 = 9$ , then the value of  $p$  are [AMU 1991]  
(a)  $\pm 3$                       (b)  $\pm 6$                       (c)  $\pm 8$                       (d)  $\pm 9$
- 209.** If  $\alpha, \beta, \gamma$  are the roots of  $2x^3 - 2x - 1 = 0$ , then  $(\sum \alpha\beta)^2 =$  [EAMCET 2002]  
(a) -1                      (b) 3                      (c) 2                      (d) 1
- 210.** If  $\alpha, \beta$  be the roots of  $x^2 + px + q = 0$  and  $\alpha + h, \beta + h$  are the roots of  $x^2 + rx + s = 0$ , then [AMU 2001]  
(a)  $\frac{p}{r} = \frac{q}{s}$                       (b)  $2h = \left[ \frac{p}{q} + \frac{r}{s} \right]$                       (c)  $p^2 - 4q = r^2 - 4s$                       (d)  $pr^2 = qs^2$
- 211.** The quadratic equation with real coefficients whose one root is  $7 + 5i$  will be [Kerala (Engg.) 2001, 02; Rajasthan PET 199  
(a)  $x^2 - 14x - 74 = 0$                       (b)  $x^2 + 14x + 74 = 0$                       (c)  $x^2 + 14x - 74 = 0$                       (d)  $x^2 - 14x + 74 = 0$
- 212.** The quadratic equation with one root as the square root of  $-47 + 8\sqrt{-3}$  is [IIT 1995]  
(a)  $x^2 + 2x + 49 = 0$                       (b)  $x^2 - 2x + 49 = 0$                       (c)  $x^2 \pm 2x + 49 = 0$                       (d)  $x^2 \pm 2x - 49 = 0$
- 213.** The quadratic equation whose one root is  $\frac{1}{2 + \sqrt{5}}$  will be [Rajasthan PET 1987]  
(a)  $x^2 + 4x - 1 = 0$                       (b)  $x^2 - 4x - 1 = 0$                       (c)  $x^2 + 4x + 1 = 0$                       (d) None of these
- 214.** The quadratic equation with one root  $2 - \sqrt{3}$  is [Rajasthan PET 1985]  
(a)  $x^2 - 4x + 1 = 0$                       (b)  $x^2 - 4x - 1 = 0$                       (c)  $x^2 + 4x + 1 = 0$                       (d)  $x^2 + 4x - 1 = 0$
- 215.** The quadratic equation whose roots are three times the roots of the equation  $3ax^2 + 3bx + c = 0$  is [AMU 1990]  
(a)  $ax^2 + bx + c = 0$                       (b)  $ax^2 + 3bx + c = 0$                       (c)  $ax^2 + bx + 3c = 0$                       (d)  $ax^2 + 3bx + 3c = 0$
- 216.** If  $\alpha, \beta$  are the roots of  $x^2 + px + q = 0$  then  $-\frac{1}{\alpha}, -\frac{1}{\beta}$  are the roots of the equation [TS Rajendra 1991]

- (a)  $qx^2 - px + 1 = 0$       (b)  $qx^2 + px + 1 = 0$       (c)  $x^2 + px + q = 0$       (d)  $x^2 - px + q = 0$
- 217.** If a root of the equation  $ax^2 + bx + c = 0$  be reciprocal of a root of the equation  $a'x^2 + b'x + c' = 0$ , then [IIT 1968]  
 (a)  $(cc' - aa')^2 = (ba' - cb')(ab' - bc')$       (b)  $(bb' - aa')^2 = (ca' - bc')(ab' - bc')$   
 (c)  $(cc' - aa')^2 = (ba' + cb')(ab' + bc')$       (d) None of these
- 218.** One root of  $ax^2 + bx + c = 0$  is reciprocal of other root if [Rajasthan PET 1985]  
 (a)  $a + c = 0$       (b)  $b + c = 0$       (c)  $b - c = 0$       (d)  $a - c = 0$
- 219.** If the roots of the equation  $5x^2 + 13x + k = 0$  be reciprocals of each other, then  $k$  is equal to [MNR 1980; Rajasthan PET 199]  
 (a) 0      (b) 5      (c)  $1/6$       (d) 6
- 220.** If one root of the equation  $x^2 = px + q$  is reciprocal of the other, then the correct relationship is [AMU 1987, 89]  
 (a)  $q = -1$       (b)  $q = 1$       (c)  $pq = -1$       (d)  $pq = 1$
- 221.** If the roots of the quadratic equation  $\frac{x-m}{mx+1} = \frac{x+n}{nx+1}$  are reciprocal to each other, then [MP PET 2001]  
 (a)  $n = 0$       (b)  $m = n$       (c)  $m + n = 1$       (d)  $m^2 + n^2 = 1$
- 222.** The roots of the quadratic equation  $ax^2 + bx + c = 0$  will be reciprocal to each other if  
 (a)  $a = \frac{1}{c}$       (b)  $a = c$       (c)  $b = ac$       (d)  $a = b$
- 223.** If the absolute difference between two roots of the equation  $x^2 + px + 3 = 0$  is  $\sqrt{p}$ , then  $p$  equals [Bihar CEE 1998]  
 (a) -3, 4      (b) 4      (c) -3      (d) None of these
- 224.** If the roots of equation  $x^2 - px + q = 0$  differ by 1, then [MP PET 1999]  
 (a)  $p^2 = 4q$       (b)  $p^2 = 4q + 1$       (c)  $p^2 = 4q - 1$       (d) None of these
- 225.** The numerical difference of the roots of  $x^2 - 7x - 9 = 0$  is  
 (a) 5      (b)  $2\sqrt{85}$       (c)  $9\sqrt{7}$       (d)  $\sqrt{85}$
- 226.** If the difference of the roots of  $x^2 - px + 8 = 0$  be 2, then the value of  $p$  is [Roorkee 1992]  
 (a)  $\pm 2$       (b)  $\pm 4$       (c)  $\pm 6$       (d)  $\pm 8$

227. If the difference of the roots of the equation  $x^2 - bx + c = 0$  be 1, then [Rajasthan PET 1991]  
 (a)  $b^2 - 4c - 1 = 0$  (b)  $b^2 - 4c = 0$  (c)  $b^2 - 4c + 1 = 0$  (d)  $b^2 + 4c - 1 = 0$
228. If the roots of the equations  $x^2 - bx + c = 0$  and  $x^2 - cx + b = 0$  differ by the same quantity, then  $b + c$  is equal to [BIT Ranchi 1969; MP PET 1993]  
 (a) 4 (b) 1 (c) 0 (d) -4
229. If the roots of  $x^2 - bx + c = 0$  are two consecutive integers, then  $b^2 - 4c$  is [Kurukshetra CEE 1998]  
 (a) 1 (b) 2 (c) 3 (d) 4
230. If  $\alpha, \beta$  are the roots of  $x^2 - 3x + a = 0, a \in R$  and  $\alpha < 1 < \beta$  then  
 (a)  $a \in (-\infty, 2)$  (b)  $a \in \left(-\infty, \frac{9}{4}\right)$  (c)  $a \in \left(2, \frac{9}{4}\right)$  (d) None of these
231. If  $\alpha, \beta$  be the roots of  $4x^2 - 16x + \lambda = 0, \lambda \in R$  such that  $1 < \alpha < 2$  and  $2 < \beta < 3$  then the number of integral solutions of  $\lambda$  is  
 (a) 5 (b) 6 (c) 2 (d) 3
232. If  $X$  denotes the set of real numbers  $p$  for which the equation  $x^2 = p(x + p)$  has its roots greater than  $p$  then  $X$  is equal to  
 (a)  $\left(-2, -\frac{1}{2}\right)$  (b)  $\left(-\frac{1}{2}, \frac{1}{4}\right)$  (c) Null set (d)  $(-\infty, 0)$
233. If one root of the quadratic equation  $ax^2 + bx + c = 0$  is equal to the  $n^{\text{th}}$  power of the other root, then the value of  $\frac{1}{(ac^n)^{n+1}} + \frac{1}{(a^n c)^{n+1}} =$  [IIT 1983]  
 (a)  $b$  (b)  $-b$  (c)  $\frac{1}{b^{n+1}}$  (d)  $-\frac{1}{b^{n+1}}$
234. If one root of the equation  $ax^2 - bx + c = 0$  is square of the other, then [Rajasthan PET 1998]  
 (a)  $a^2c + ac^2 + 3abc - b^3 = 0$  (b)  $a^2c + ac^2 - 3abc + b^3 = 0$  (c)  $a^3 + b^3 = 3abc$  (d)  $(a + b)^3 = 3abc$
235. For the equation  $3x^2 + px + 3, p > 0$  if one of the root is square of the other, then  $p$  is equal to [IIT Screening 2000]  
 (a)  $\frac{1}{3}$  (b) 1 (c) 3 (d)  $\frac{2}{3}$
236. If one root of equation  $px^2 - qx + r = 0$  is double of the other, then  
 (a)  $9q^2 = 2pr$  (b)  $2q^2 = 9pr$  (c)  $3q^2 = 4pr$  (d)  $4q^2 = 3pr$
237. The value of  $k$  for which one of the roots of  $x^2 - x + 3k = 0$  is double of one of the roots of  $x^2 - x + k = 0$  is [UPSEAT 2001]  
 (a) 1 (b) -2 (c) 2 (d) None of these
238. The function  $f(x) = ax^2 + 2x + 1$  has one double root if [AMU 1989]  
 (a)  $a = 0$  (b)  $a = -1$  (c)  $a = 1$  (d)  $a = 2$
239. If  $\sin \alpha, \cos \alpha$  are the roots of the equation  $ax^2 + bx + c = 0$ , then [MP PET 1993]  
 (a)  $a^2 - b^2 + 2ac = 0$  (b)  $(a - c)^2 = b^2 + c^2$  (c)  $a^2 + b^2 - 2ac = 0$  (d)  $a^2 + b^2 + 2ac = 0$
240. If the roots of  $ax^2 + bx + c = 0$  are  $\alpha, \beta$  and root of  $Ax^2 + Bx + c = 0$  are  $\alpha - k, \beta - k$ , then  $\frac{B^2 - 4AC}{b^2 - 4ac}$  is equal to [Rajasthan PET 1999]  
 (a)  $\frac{a}{A}$  (b)  $\frac{A}{a}$  (c)  $\left(\frac{a}{A}\right)^2$  (d)  $\left(\frac{A}{a}\right)^2$
241. If the product of roots of the equation  $x^2 - 3kx + 2e^{2 \log k} - 1 = 0$  is 7, then its roots will real when [Pb. CET 1990; IIT 1984]  
 (a)  $k = 1$  (b)  $k = 2$  (c)  $k = 3$  (d) None of these

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242. If  $a$  and  $b$  are rational and  $b$  is not a perfect square then the quadratic equation with rational coefficients whose one root is  $\frac{1}{a + \sqrt{b}}$  is
- (a)  $x^2 - 2ax + (a^2 - b) = 0$  (b)  $(a^2 - b)x^2 - 2ax + 1 = 0$  (c)  $(a^2 - b)x^2 - 2bx + 1 = 0$  (d) None of these
243. If  $\frac{1}{4 - 3i}$  is a root of  $ax^2 + bx + 1 = 0$ , where  $a, b$  are real, then
- (a)  $a = 25, b = -8$  (b)  $a = 25, b = 8$  (c)  $a = 5, b = 4$  (d) None of these
244. If  $\alpha, \beta, \gamma$  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)  $\frac{1}{2}$  (c)  $-\frac{1}{2}$  (d) None of these
245. If the roots of  $x^3 - 12x^2 + 39x - 28 = 0$  are in A.P. then their common difference is
- (a)  $\pm 1$  (b)  $\pm 2$  (c)  $\pm 3$  (d)  $\pm 4$
246. The roots of the equation  $x^3 + 14x^2 - 84x - 216 = 0$  are in
- (a) A.P. (b) G.P. (c) H.P. (d) None of these
247. If  $3$  and  $1 + \sqrt{2}$  are two roots of a cubic equation with rational coefficients, then the equation is
- (a)  $x^3 - 5x^2 + 9x - 9 = 0$  (b)  $x^3 - 3x^2 - 4x + 12 = 0$  (c)  $x^3 - 5x^2 + 7x + 3 = 0$  (d) None of these
248. What is the sum of the squares of roots of  $x^2 - 3x + 1 = 0$  [Karnataka CET 1993]
- (a)  $5$  (b)  $7$  (c)  $9$  (d)  $10$
249. If  $\alpha + \beta = 3$  and  $\alpha^3 + \beta^3 = 27$ , then  $\alpha$  and  $\beta$  are the roots of
- (a)  $3x^2 + 9x + 7 = 0$  (b)  $9x^2 - 27x + 20 = 0$  (c)  $2x^2 - 6x + 15 = 0$  (d) None of these
250. For what value of  $\lambda$  the sum of the squares of the roots of  $x^2 + (2 + \lambda)x - \frac{1}{2}(1 + \lambda) = 0$  is minimum [AMU 1999]
- (a)  $3/2$  (b)  $1$  (c)  $1/2$  (d)  $11/4$
251. The value of  $a(a \geq 3)$  for which the sum of the cubes of the roots of  $x^2 - (a - 2)x + (a - 3) = 0$ , assumes the least value is [Orissa JEE 2002]
- (a)  $3$  (b)  $4$  (c)  $5$  (d) None of these
252. Let  $\alpha, \beta$  be the roots of  $x^2 + (3 - \lambda)x - \lambda = 0$ . The value of  $\lambda$  for which  $\alpha^2 + \beta^2$  is minimum, is [AMU 2000]
- (a)  $0$  (b)  $1$  (c)  $2$  (d)  $3$
253. If the sum of squares of the roots of the equation  $x^2 - (a - 2)x - (a + 1) = 0$  is least, then the value of  $a$  is [Rajasthan PET 2000. Pb. CET 2002]
- (a)  $0$  (b)  $2$  (c)  $-1$  (d)  $1$
254. If  $\alpha, \beta$  are roots of  $Ax^2 + Bx + C = 0$  and  $\alpha^2, \beta^2$  are roots of  $x^2 + px + q = 0$ , then  $p$  is equal to [Rajasthan PET 1986]
- (a)  $(B^2 - 2AC)/A^2$  (b)  $(2AC - B^2)/A^2$  (c)  $(B^2 - 4AC)/A^2$  (d)  $(4AC - B^2)/A^2$
255. If  $\alpha, \beta$  are 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 [Rajasthan PET 1987, 93]
- (a)  $-1$  (b)  $1$  (c)  $-2$  (d)  $2$
256. If  $\alpha, \beta$  are real and  $\alpha^2, \beta^2$  are the roots of the equation  $a^2x^2 + x + 1 - a^2 = 0 (a > 1)$ , then  $\beta^2 =$  [EAMCET 1999]
- (a)  $a^2$  (b)  $1 - \frac{1}{a^2}$  (c)  $1 - a^2$  (d)  $1 + a^2$
257. The H.M. of the roots of the equation  $x^2 - 8x + 4 = 0$  is [Rajasthan PET 1988]
- (a)  $1$  (b)  $2$  (c)  $3$  (d) None of these
258. If  $\alpha, \beta$  are the roots of the equation  $x^2 + x\sqrt{\alpha} + \beta = 0$ , then the value of  $\alpha$  and  $\beta$  are [AMU 1990, 92]
- (a)  $\alpha = 1$  and  $\beta = -1$  (b)  $\alpha = 1$  and  $\beta = -2$  (c)  $\alpha = 2$  and  $\beta = 1$  (d)  $\alpha = 2$  and  $\beta = -2$
259. If  $p$  and  $q$  are the roots of  $x^2 + px + q = 0$ , then [IIT 1995, AIEEE 2002]
- (a)  $p = 1$  (b)  $p = -2$  (c)  $p = 1$  or  $0$  (d)  $p = -2$  or  $0$



260. If roots of the equation  $2x^2 - (a^2 + 8a + 1)x + a^2 - 4a = 0$  are in opposite sign, then [AMU 1998]  
 (a)  $0 < a < 4$  (b)  $a > 0$  (c)  $a < 8$  (d)  $-4 < a < 0$
261. Which of the following equation has 1 and -2 as the roots [SCRA 1999]  
 (a)  $x^2 - x - 2 = 0$  (b)  $x^2 + x - 2 = 0$  (c)  $x^2 - x + 2 = 0$  (d)  $x^2 + x + 2 = 0$
262. If the roots of the equation  $x^2 + x + 1 = 0$  are in the ratio  $m : n$  then [Rajasthan PET 1994]  
 (a)  $\sqrt{\frac{m}{n}} + \sqrt{\frac{n}{m}} + 1 = 0$  (b)  $\sqrt{m} + \sqrt{n} + 1 = 0$  (c)  $\frac{m}{n} + \frac{n}{m} + 1 = 0$  (d)  $m + n + 1 = 0$
263. If the roots of the equation  $lx^2 + nx + n = 0$  are in the ratio  $p : q$  then  $\sqrt{\frac{p}{q}} + \sqrt{\frac{q}{p}}$  is equal to [Rajasthan PET 1997; BIT Ranchi]  
 (a)  $\sqrt{n/l}$  (b)  $\sqrt{l/n}$  (c)  $\pm\sqrt{n/l}$  (d)  $-\sqrt{l/n}$
264. If the roots of the equation  $12x^2 - mx + 5 = 0$  are in the ratio 2 : 3, then  $m =$  [Rajasthan PET 2002]  
 (a)  $5\sqrt{10}$  (b)  $3\sqrt{10}$  (c)  $2\sqrt{10}$  (d) None of these
265. If the ratio of the roots of the equation  $ax^2 + bx + c = 0$  be  $p : q$ , then [Pb. CET 1994]  
 (a)  $pqb^2 + (P+q)^2ac = 0$  (b)  $pqb^2 - (P+q)^2ac = 0$  (c)  $pqa^2 - (P+q)^2bc = 0$  (d) None of these
266. The two roots of an equation  $x^3 - 9x^2 + 14x + 24 = 0$  are in the ratio 3 : 2. The roots will be [UPSEAT 1999]  
 (a) 6, 4, -1 (b) 6, 4, 1 (c) -6, 4, 1 (d) -6, -4, 1
267. The condition that one root of the equation  $ax^2 + bx + c = 0$  is three times the other is [DCE 2002]  
 (a)  $b^2 = 8ac$  (b)  $3b^2 + 16ac = 0$  (c)  $3b^2 = 16ac$  (d)  $b^2 + 3ac = 0$
268. If the roots of the equation  $\frac{x^2 - bx}{ax - c} = \frac{\lambda - 1}{\lambda + 1}$  are such that  $\alpha + \beta = 0$ , then the value of  $\lambda$  is [Kurukhstra CEE 1995; MP PET 1996, 2002; Rajasthan PET 2001]  
 (a)  $\frac{a-b}{a+b}$  (b)  $c$  (c)  $\frac{1}{c}$  (d)  $\frac{a+b}{a-b}$
269. For the equation  $\frac{1}{x+a} - \frac{1}{x+b} = \frac{1}{x+c}$ , if the product of the roots is zero, then the sum of the roots is [AMU 1992]  
 (a) 0 (b)  $\frac{2ab}{b+c}$  (c)  $\frac{2bc}{b+c}$  (d)  $-\frac{2bc}{b+c}$
270. If the sum of two of the roots of  $x^3 + px^2 + qx + r = 0$  is zero, then  $pq =$  [EAMCET 2003]  
 (a)  $-r$  (b)  $r$  (c)  $2r$  (d)  $-2r$
271. If the roots of the equation  $\frac{1}{x+p} + \frac{1}{x+q} = \frac{1}{r}$  are equal in magnitude but opposite in sign, then the product of the roots will be [IIT 1967]  
 (a)  $\frac{p^2 + q^2}{2}$  (b)  $-\frac{(p^2 + q^2)}{2}$  (c)  $\frac{p^2 - q^2}{2}$  (d)  $-\frac{(p^2 - q^2)}{2}$
272. The value of  $m$  for which the equation  $x^3 - mx^2 + 3x - 2 = 0$  has two roots equal in magnitude but opposite in sign, is [Kurukhstra CEE 1996]  
 (a)  $1/2$  (b)  $2/3$  (c)  $3/4$  (d)  $4/5$
273. If  $ax^2 + bx + c = a(x - \alpha)(x - \beta)$ , then  $a(ax + 1)(\beta x + 1)$  is equal to [AMU 1986]  
 (a)  $ax^2 + bx + c$  (b)  $cx^2 - bx + a$  (c)  $cx^2 - bx - a$  (d)  $cx^2 + bx + a$
274. If  $\alpha, \beta$  are the roots of the equation  $ax^2 + bx + c = 0$  ( $a \neq 0$ ) and  $\alpha + \delta, \beta + \delta$  are the roots of  $Ax^2 + Bx + C = 0$  ( $A \neq 0$ ) for some constant, then [IIT 2000]  
 (a)  $\frac{b^2 - 4ac}{a^2} = \frac{B^2 - 4AC}{A^2}$  (b)  $\frac{b^2 - 2ac}{a^2} = \frac{B^2 - 2AC}{A^2}$  (c)  $\frac{b^2 - 8ac}{a^2} = \frac{B^2 - 8AC}{A^2}$  (d) None of these
275. In a triangle  $PQR$ ,  $\angle R = \frac{\pi}{2}$ . If  $\tan\left(\frac{P}{2}\right)$  and  $\tan\left(\frac{Q}{2}\right)$  are the roots of the equation  $ax^2 + bx + c = 0$  ( $a \neq 0$ ), then [IIT 1999]  
 (a)  $a + b = c$  (b)  $b + c = 0$  (c)  $a + c = b$  (d)  $b = c$

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- 276.** The product of all real roots of the equation  $x^2 - |x| - 6 = 0$  is [Roorkee 2000]  
 (a)  $-9$  (b)  $6$  (c)  $9$  (d)  $36$
- 277.** If the sum of the roots of the equation  $ax^2 + bx + c = 0$  is equal to the sum of the squares of their reciprocals then  $bc^2, ca^2, ab^2$  are in [IIT 1976]  
 (a) A.P. (b) G.P. (c) H.P. (d) None of these
- 278.** The roots of the equation  $x^2 - 2x + A = 0$  are  $p, q$  and the roots of the equation  $x^2 - 18x + B = 0$  are  $r, s$ . If  $p < q < r < s$  are in A.P., then [IIT 1997]  
 (a)  $A = 3, B = 77$  (b)  $A = -3, B = 77$  (c)  $A = 3, B = -77$  (d)  $A = -3, B = -77$
- 279.** If the roots of the equation  $x^2 + bx + c = 0$  and  $x^2 + qx + r = 0$  are in the same ratio, then [EAMCET 1994]  
 (a)  $r^2c = qb^2$  (b)  $r^2b = qc^2$  (c)  $c^2r = q^2b$  (d)  $b^2r = q^2c$
- 280.** If one root of the equation  $x^2 + px + q = 0$  is  $2 + \sqrt{3}$ , then values of  $p$  and  $q$  are [UPSEAT 2002]  
 (a)  $-4, 1$  (b)  $4, -1$  (c)  $2, \sqrt{3}$  (d)  $-2, -\sqrt{3}$
- 281.** If  $1 - i$  is a root of the equation  $x^2 - ax + b = 0$ , then  $b =$  [EAMCET 2002]  
 (a)  $-2$  (b)  $-1$  (c)  $1$  (d)  $2$

### Advance Level

- 282.** If  $\alpha, \beta$  are the roots of  $x^2 + px + 1 = 0$  and  $\gamma, \delta$  are the roots of  $x^2 + qx + 1 = 0$ , then  $q^2 - p^2 =$  [IIT 1978; DCE 2000]  
 (a)  $(\alpha - \gamma)(\beta - \gamma)(\alpha + \delta)(\beta + \delta)$  (b)  $(\alpha + \gamma)(\beta + \gamma)(\alpha - \delta)(\beta + \delta)$   
 (c)  $(\alpha + \gamma)(\beta + \gamma)(\alpha + \delta)(\beta + \delta)$  (d) None of these
- 283.** If  $\alpha, \beta$  be the roots of  $x^2 - px + q = 0$  and  $\alpha', \beta'$  be 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)  $2\{p^2 - 2q - p'^2 - 2q' - qq'\}$
- 284.** If  $\alpha$  and  $\beta$  are the roots of the equation  $x^2 - ax + b = 0$  and  $A_n = \alpha^n + \beta^n$ , then which of the following is true [Karnataka CET 2000]  
 (a)  $A_{n+1} = aA_n + bA_{n-1}$  (b)  $A_{n+1} = bA_n + aA_{n-1}$  (c)  $A_{n+1} = aA_n - bA_{n-1}$  (d)  $A_{n+1} = bA_n - aA_{n-1}$
- 285.** If roots of an equation  $x^n - 1 = 0$  are  $1, a_1, a_2, \dots, a_{n-1}$ , then the value of  $(1 - a_1)(1 - a_2)(1 - a_3) \dots (1 - a_{n-1})$  will be [UPSEAT 1999]  
 (a)  $n$  (b)  $n^2$  (c)  $n^n$  (d)  $0$
- 286.** If  $\alpha$  and  $\beta$  are the roots of  $6x^2 - 6x + 1 = 0$ , then the value of  $\frac{1}{2}[a + b\alpha + c\alpha^2 + d\alpha^3] + \frac{1}{2}[a + b\beta + c\beta^2 + d\beta^3]$  is [Rajasthan PET 2000]  
 (a)  $\frac{1}{4}(a + b + c + d)$  (b)  $\frac{a}{1} + \frac{b}{2} + \frac{c}{3} + \frac{d}{4}$  (c)  $\frac{a}{1} - \frac{b}{2} + \frac{c}{3} - \frac{d}{4}$  (d) None of these
- 287.** If  $\alpha_1, \alpha_2$  are the roots of equation  $x^2 - px + 1 = 0$  and  $\beta_1, \beta_2$  be those of equation  $x^2 - qx + 1 = 0$  and vector  $\alpha_1\hat{i} + \beta_1\hat{j}$  is parallel to  $\alpha_2\hat{i} + \beta_2\hat{j}$ , then  
 (a)  $p = \pm q$  (b)  $p = \pm 2q$  (c)  $p = 2q$  (d) None of these
- 288.** If the roots of  $a_1x^2 + b_1x + c_1 = 0$  are  $\alpha_1$  and  $\beta_1$  and those of  $a_2x^2 + b_2x + c_2 = 0$  are  $\alpha_2$  and  $\beta_2$  such that  $\alpha_1\alpha_2 = \beta_1\beta_2 = 1$ , then  
 (a)  $\frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2}$  (b)  $\frac{a_1}{c_2} = \frac{b_1}{b_2} = \frac{c_1}{a_2}$  (c)  $a_1a_2 = b_1b_2 = c_1c_2$  (d) None of these
- 289.** If the sum of the roots of the equation  $qx^2 + 2x + 3q = 0$  is equal to their product, then the value of  $q$  is equal to

- (a)  $-\frac{2}{3}$                       (b)  $\frac{3}{2}$                       (c) 3                      (d) -6

- 290.** If  $x = (\beta - \gamma)(\alpha - \delta)$ ,  $y = (\gamma - \alpha)(\beta - \delta)$ ,  $z = (\alpha - \beta)(\gamma - \delta)$ , then the value of  $x^3 + y^3 + z^3 - 3xyz$  is  
 (a) 0                      (b)  $\alpha^6 + \beta^6 + \gamma^6 + \delta^6$                       (c)  $\alpha^6 \beta^6 \gamma^6 \delta^6$                       (d) None of these
- 291.** If  $\alpha, \beta, \gamma$  are the roots of the equation  $x^3 + px^2 + qx + r = 0$ , then  $(1 - \alpha^2)(1 - \beta^2)(1 - \gamma^2)$  is equal to  
 (a)  $(1 + q)^2 - (p + r)^2$                       (b)  $(1 + q)^2 + (p + r)^2$                       (c)  $(1 - q)^2 + (p - r)^2$                       (d) None of these
- 292.** If  $\alpha, \beta, \gamma$  are the roots of the equation  $x^3 + ax + b = 0$ , then  $\frac{\alpha^3 + \beta^3 + \gamma^3}{\alpha^2 + \beta^2 + \gamma^2} =$   
 (a)  $\frac{3b}{2a}$                       (b)  $\frac{-3b}{2a}$                       (c)  $3b$                       (d)  $2a$
- 293.** If  $\alpha, \beta$  are the roots of  $6x^2 - 2x + 1 = 0$  and  $s_x = \alpha^n + \beta^n$ , then  $\lim_{n \rightarrow \infty} \sum_{r=1}^n s_r$  is  
 (a)  $\frac{5}{17}$                       (b) 0                      (c)  $\frac{3}{37}$                       (d) None of these
- 294.** Let  $\alpha, \beta$  be the roots of the equation  $ax^2 + bx + c = 0$  and let  $\alpha^n + \beta^n = S_n$  for  $n \geq 1$ . Then the value of the determinant  

$$\begin{vmatrix} 3 & 1 + S_1 & 1 + S_2 \\ 1 + S_1 & 1 + S_2 & 1 + S_3 \\ 1 + S_2 & 1 + S_3 & 1 + S_4 \end{vmatrix}$$
 is  
 (a)  $\frac{b^2 - 4ac}{a^4}$                       (b)  $\frac{(a + b + c)(b^2 + 4ac)}{a^4}$                       (c)  $\frac{(a + b + c)(b^2 - 4ac)}{a^4}$                       (d)  $\frac{(a + b + c)^2(b^2 - 4ac)}{a^4}$
- 295.** If  $\alpha, \beta$  are roots of the equation  $2x^2 + 6x + b = 0$  ( $b < 0$ ), then  $\frac{\alpha}{\beta} + \frac{\beta}{\alpha}$  is less than  
 (a) 2                      (b) -2                      (c) 18                      (d) None of these
- 296.** If  $\alpha, \beta$  are roots of the equation  $ax^2 + 3x + 2 = 0$  ( $a < 0$ ), then  $\frac{\alpha^2}{\beta} + \frac{\beta^2}{\alpha}$  is greater than  
 (a) 0                      (b) 1                      (c) 2                      (d) None of these
- 297.** 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) 5                      (b) 9                      (c) 11                      (d) 13
- 298.** If  $\alpha$  and  $\beta$  are the roots of the equation  $x^2 - p(x + 1) - q = 0$ , then the value of  $\frac{\alpha^2 + 2\alpha + 1}{\alpha^2 + 2\alpha + q} + \frac{\beta^2 + 2\beta + 1}{\beta^2 + 2\beta + q}$  is  
 (a) 2                      (b) 3                      (c) 0                      (d) 1
- 299.** If  $A, G, H$  be respectively, the A.M., G.M. and H.M. of three positive number  $a, b, c$  then the equation whose roots are these number is given by  
 (a)  $x^3 - 3Ax^2 + G^3(3x - 1) = 0$                       (b)  $x^3 - 3Ax^2 + 3(G^3/H)x - G^3 = 0$   
 (c)  $x^3 + 3Ax^2 + 3(G^3/H)x - G^3 = 0$                       (d)  $x^3 - 3Ax^2 - 3(G^3/H)x + G^3 = 0$
- 300.** Let  $a = \cos \frac{2\pi}{7} + i \sin \frac{2\pi}{7}$ ,  $A = a + a^2 + a^4$  and  $B = a^3 + a^5 + a^6$  then  $A$  and  $B$  are roots of the equation [Rajasthan PET 2000]  
 (a)  $x^2 - x + 2 = 0$                       (b)  $x^2 - x - 2 = 0$                       (c)  $x^2 + x + 2 = 0$                       (d) None of these
- 301.** If  $\alpha, \beta$  are the roots of the equation  $x^2 - px + q = 0$ , then the quadratic equation whose roots are  $(\alpha^2 - \beta^2)(\alpha^3 - \beta^3)$  and  $\alpha^3\beta^2 + \alpha^2\beta^3$  is [Roorkee 1994]  
 (a)  $x^2 - Sx + P = 0$                       (b)  $x^2 + Sx + P = 0$                       (c)  $x^2 + Sx - P = 0$                       (d) None of these  
 [Where  $S = p(p^4 - 5p^2q + 5q^2)$  and  $P = p^2q^2(p^4 - 5p^2q + 4q^2)$ ]
- 302.** Let  $A, G$  and  $H$  are the A.M., G.M. and H.M. respectively of two unequal positive integers. Then the equation  $Ax^2 - |G| x - H = 0$  has  
 (a) Both roots as fractions                      (b) At least one root which is a negative fraction  
 (c) Exactly one positive root                      (d) At least one root which is an integer

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303. Let  $x^2 - px + q = 0$ , where  $p \in R, q \in R$ , have the roots  $\alpha, \beta$  such that  $\alpha + 2\beta = 0$  then  
 (a)  $2p^2 + q = 0$  (b)  $2q^2 + p = 0$  (c)  $q < 0$  (d) None of these
304. The cubic equation whose roots are the A.M., G.M. and H.M. of the roots of  $x^2 - 2px + q^2 = 0$  is  
 (a)  $(x - p)(x - q)(x - p - q) = 0$  (b)  $(x - p)(x - |q|)(px - q^2) = 0$   
 (c)  $x^3 - \left(p + |q| + \frac{q^2}{p}\right)x^2 + \left(p|q| + q^2 + \frac{|q|^3}{p}\right)x - |q|^3 = 0$  (d) None of these
305. If  $\alpha, \beta$  are the roots of  $x^2 + px + q = 0$  and also of  $x^{2n} + p^n x^n + q^n = 0$  and if  $\frac{\alpha}{\beta}, \frac{\beta}{\alpha}$  are the roots of  $x^n + 1 + (x + 1)^n = 0$ , then  $n$  is  
 (a) An odd integer (b) An even integer (c) Any integer (d) None of these
306. If  $\cos^4 x + \sin^2 x - p = 0, p \in R$  has real solutions then  
 (a)  $p \leq 1$  (b)  $\frac{3}{4} \leq p \leq 1$  (c)  $p \geq \frac{3}{4}$  (d) None of these
307. If the ratio of the roots of  $\lambda x^2 + \mu x + \nu = 0$  is equal to the ratio of the roots of  $x^2 + x + 1 = 0$  then  $\lambda, \mu, \nu$  are in  
 (a) A.P. (b) G.P. (c) H.P. (d) None of these
308.  $P, q, r$  and  $s$  are integers. If the A.M. of the roots of  $x^2 - px + q^2 = 0$  and G.M. of the roots of  $x^2 - rx + s^2 = 0$  are equal then  
 (a)  $q$  is an odd integer (b)  $r$  is an even integer (c)  $p$  is an even integer (d)  $s$  is an odd integer
309. 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
310. The harmonic mean of the roots of the equation  $(5 + \sqrt{2})x^2 - (4 + \sqrt{5})x + 8 + 2\sqrt{5} = 0$  is  
 (a) 2 (b) 4 (c) 6 (d) 8
311. If  $\alpha, \beta$  are the roots of  $ax^2 + c = bx$  then the equation  $(a + cy)^2 = b^2 y$  in  $y$  has the roots  
 (a)  $\alpha^{-1}, \beta^{-1}$  (b)  $\alpha^2, \beta^2$  (c)  $\alpha\beta^{-1}, \alpha^{-1}\beta$  (d)  $\alpha^{-2}, \beta^{-2}$
312. If the roots of  $ax^2 - bx - c = 0$  change by the same quantity then the expression in  $a, b, c$  that does not change is  
 (a)  $\frac{b^2 - 4ac}{a^2}$  (b)  $\frac{b - 4c}{a}$  (c)  $\frac{b^2 + 4ac}{a^2}$  (d) None of these
313. If  $\alpha, \beta$  are the roots of  $x^2 - px + q = 0$  then the product of the roots of the quadratic equation whose roots are  $\alpha^2 - \beta^2$  and  $\alpha^3 - \beta^3$  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
314. The quadratic equation whose roots are the A.M. and H.M. of the roots of the equation  $x^2 + 7x - 1 = 0$  is  
 (a)  $14x^2 + 14x - 45 = 0$  (b)  $45x^2 - 14x + 14 = 0$  (c)  $14x^2 + 45x - 14 = 0$  (d) None of these
315. If  $z_0 = \alpha + i\beta, i = \sqrt{-1}$ , then the roots of the cubic equation  $x^3 - 2(1 + \alpha)x^2 + (4\alpha + \alpha^2 + \beta^2)x + 2(\alpha^2 + \beta^2) = 0$  are  
 (a)  $2, z_0, \bar{z}_0$  (b)  $1, z_0, -z_0$  (c)  $2, z_0, -\bar{z}_0$  (d)  $2, -z_0, \bar{z}_0$
316. Let  $a, b, c$  be real numbers and  $a \neq 0$ . If  $\alpha$  is a root of  $a^2 x^2 + bx + c = 0$ ,  $\beta$  is a root of  $a^2 x^2 - bx - c = 0$ , and  $0 < \alpha < \beta$  then the equation  $a^2 x^2 + 2bx + 2c = 0$  has a root  $\gamma$  that always satisfies  
 (a)  $\gamma = \frac{1}{2}(\alpha + \beta)$  (b)  $\gamma = \alpha + \frac{\beta}{2}$  (c)  $\gamma = \alpha$  (d)  $\alpha < \gamma < \beta$
317. If  $(\lambda^2 + \lambda - 2)x^2 + (\lambda + 2)x < 1$  for all  $x \in R$ , then  $\lambda$  belongs to the interval  
 (a)  $(-2, 1)$  (b)  $\left(-2, \frac{2}{5}\right)$  (c)  $\left(\frac{2}{5}, 1\right)$  (d) None of these
318. The least integral value of  $k$  for which  $(k - 2)x^2 + 8x + k + 4 > 0$  for all  $x \in R$ , is  
 (a) 5 (b) 4 (c) 3 (d) None of these

319. The set of possible values of  $\lambda$  for which  $x^2 - (\lambda^2 - 5\lambda + 5)x + (2\lambda^2 - 3\lambda - 4) = 0$  has roots whose sum and product are both less than 1 is
- (a)  $\left(-1, \frac{5}{2}\right)$                       (b) (1, 4)                      (c)  $\left[1, \frac{5}{2}\right]$                       (d)  $\left(1, \frac{5}{2}\right)$
320. The set of the possible values of  $x$  such that  $5^x + (2\sqrt{3})^{2x} - 169$  is always positive is
- (a)  $[3, +\infty)$                       (b)  $[2, +\infty)$                       (c)  $(2, +\infty)$                       (d) None of these
321. If all real value of  $x$  obtained from the equation  $4^x - (a-3)2^x + a - 4 = 0$  are nonpositive then
- (a)  $a \in (4, 5]$                       (b)  $a \in (0, 4)$                       (c)  $a \in (4, +\infty)$                       (d) None of these
322. If  $ax^2 + bx + 6 = 0$  does not have two distinct real roots  $a \in R, b \in R$ , then the least value of  $3a + b$  is
- (a) 4                      (b) -1                      (c) 1                      (d) -2
323. If  $ab = 2a + 3b, a > 0, b > 0$  then the minimum value of  $ab$  is
- (a) 12                      (b) 24                      (c)  $\frac{1}{4}$                       (d) None of these
324. The number of values of  $k$  for which  $\{x^2 - (k-2)x + k^2\}\{x^2 + kx + (2k-1)\}$  is a perfect square is
- (a) 1                      (b) 2                      (c) 0                      (d) None of these
325. If  $x^2 - bx + c = 0$  has equal integral roots then
- (a)  $b$  and  $c$  are integers  
 (b)  $b$  and  $c$  are even integers  
 (c)  $b$  is an even integer and  $c$  is a perfect square of a positive integer  
 (d) None of these
326. Let  $A, G$  and  $H$  be the A.M., G.M. and H.M. of two positive number  $a$  and  $b$ . The quadratic equation whose roots are  $A$  and  $H$  is
- (a)  $Ax^2 - (A^2 + G^2)x + AG^2 = 0$                       (b)  $Ax^2 - (A^2 + H^2)x + AH^2 = 0$   
 (c)  $Hx^2 - (H^2 + G^2)x + HG^2 = 0$                       (d) None of these
327. If  $x^2 + y^2 + z^2 = 1$ , then the value of  $xy + yz + zx$  lies in the interval
- (a)  $\left[\frac{1}{2}, 2\right]$                       (b)  $[-1, 2]$                       (c)  $\left[-\frac{1}{2}, 1\right]$                       (d)  $\left[-1, \frac{1}{2}\right]$
328. If  $px^2 + qx + r = 0$  has no real roots and  $p, q, r$  are real such that  $p + r > 0$ , then
- (a)  $p - q + r < 0$                       (b)  $p - q + r > 0$                       (c)  $p + r = q$                       (d) All of these
329. The quadratic equation  $x^2 - 2x - \lambda = 0, \lambda \neq 0$
- (a) Cannot have a real root if  $\lambda < -1$   
 (b) Can have a rational root if  $\lambda$  is a perfect square  
 (c) Cannot have an integral root if  $n^2 - 1 < \lambda < n^2 + 2n$  where  $n = 0, 1, 2, 3, \dots$   
 (d) None of these
330. A quadratic equation whose roots are  $\left(\frac{\gamma}{\alpha}\right)^2$  and  $\left(\frac{\beta}{\alpha}\right)^2$ , where  $\alpha, \beta, \gamma$  are the roots of  $x^3 + 27 = 0$ , is
- (a)  $x^2 - x + 1 = 0$                       (b)  $x^2 + 3x + 9 = 0$                       (c)  $x^2 + x + 1 = 0$                       (d)  $x^2 - 3x + 9 = 0$
331. If  $a, b$  are the real roots of  $x^2 + px + 1 = 0$  and  $c, d$  are the real roots of  $x^2 + qx + 1 = 0$ , then  $(a-c)(b-c)(a+d)(b+d)$  is divisible by
- (a)  $a + b + c + d$                       (b)  $a + b - c - d$                       (c)  $a - b + c - d$                       (d)  $a - b - c - d$
332. If  $0 < a < 5, 0 < b < 5$  and  $\frac{x^2 + 5}{2} = x - 2\cos(a + bx)$  is satisfied for at least one real  $x$  then the greatest value of  $a + b$  is
- (a)  $\pi$                       (b)  $\frac{\pi}{2}$                       (c)  $3\pi$                       (d)  $4\pi$
333.  $a(x^2 - y^2) + \lambda\{x(y+1) + 1\}$  can be resolved into linear rational factors. Then

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- (a)  $\lambda = 1$  (b)  $\lambda = \frac{4a^2}{a-1}, a \neq 1$  (c)  $\lambda = 0, a = 1$  (d) None of these

334. If  $\alpha, \beta$  are the roots of the equation  $x^2 + x + 3 = 0$  then equation  $3x^2 + 5x + 3 = 0$  has a root

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

335. If  $\alpha, \beta$  are the roots of  $x^2 - 2ax + b^2 = 0$  and  $\gamma, \delta$  are the roots of  $x^2 - 2bx + a^2 = 0$ , then

- (a) A.M. of  $\alpha, \beta =$  G.M. of  $\gamma, \delta$  (b) G.M. of  $\alpha, \beta =$  A.M. of  $\gamma, \delta$   
 (c)  $\alpha, \beta, \gamma, \delta$  are in A.P. (d)  $\alpha, \beta, \gamma, \delta$  are in G.P.

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

- (a) -2 (b) 4 (c) 2 (d) None of these

### Condition for common roots

#### Basic Level

337. If equations  $x^2 + bx + a = 0$  and  $x^2 + ax + b = 0$  have one root common and  $a \neq b$ , then

- (a)  $a + b = 1$  (b)  $a - b = 1$  (c)  $a + b = -1$  (d)  $a + b = 0$  [Rajasthan PET 1992; IIT 1986]

338. If equations  $x^2 + 2x + 3\lambda = 0$  and  $2x^2 + 3x + 5\lambda = 0$  have one non-zero root common, then  $\lambda$  is equal to [Rajasthan PET 19

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

339. If  $x^2 + ax + 10 = 0$  and  $x^2 + bx - 10 = 0$  have a common root, then  $a^2 - b^2$  is equal to [Kerala (Engg.) 2002]

- (a) 10 (b) 20 (c) 30 (d) 40

340. If two equations  $a_1x^2 + b_1x + c_1 = 0$  and  $a_2x^2 + b_2x + c_2 = 0$  have a common root, then the value of  $(a_1b_2 - a_2b_1)(b_1c_2 - c_1b_2)$  is

- (a)  $-(a_1c_2 - a_2c_1)^2$  (b)  $(a_1a_2 - c_1c_2)^2$  (c)  $(a_1c_1 - a_2c_2)^2$  (d)  $(a_1c_2 - c_1a_2)^2$  [Roorkee 1992]

341. If the roots of  $a_1x^2 + b_1x + c_1 = 0$  and  $a_2x^2 + b_2x + c_2 = 0$  are the same, then [Kurukshetra CEE 1995]

- (a)  $a_1 = a_2, b_1 = b_2, c_1 = c_2$  (b)  $c_1 = c_2 = 0$   
 (c)  $\frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2}$  (d)  $a_1 = b_1 = c_1; a_2 = b_2 = c_2$

342. If one root of the equation  $(k^2 + 1)x^2 + 13x + 4k = 0$  is reciprocal of the other then  $k$  has the value

- (a)  $-2 + \sqrt{3}$  (b)  $2 - \sqrt{3}$  (c) 1 (d) None of these

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

- (a)  $\pm 2\sqrt{2}$  (b)  $2\sqrt{2}$  (c) 3 (d) None of these

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

- (a)  $p < -1$  or  $p > 4$  (b)  $p > 4$  (c)  $-1 < p < 4$  (d)  $0 \leq p < 4$

345. If  $\alpha, \beta$  are roots of  $x^2 + px + q = 0$  and  $\gamma, \delta$  are the roots of  $x^2 + px - r = 0$ , then  $(\alpha - \gamma)(\alpha - \delta)$  is equal to

- (a)  $q + r$  (b)  $q - r$  (c)  $-(q + r)$  (d)  $-(p + q + r)$

346. If the equation  $2x^2 + 3x + 5\lambda = 0$  and  $x^2 + 2x + 3\lambda = 0$  have a common root, then  $\lambda =$  [Rajasthan PET 1989]

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

347. If a root of the equations  $x^2 + px + q = 0$  and  $x^2 + ax + \beta = 0$  is common, then its value will be (where  $p \neq \alpha$  and  $q \neq \beta$ )

- (a)  $\frac{q - \beta}{\alpha - p}$  (b)  $\frac{p\beta - \alpha q}{q - \beta}$  (c)  $\frac{q - \beta}{\alpha - p}$  or  $\frac{p\beta - \alpha q}{q - \beta}$  (d) None of these [IIT 1974, 76; Rajasthan PET 1997]

348. If  $ax^2 + bx + c = 0$  and  $bx^2 + cx + a = 0$  have a common root and  $a \neq 0$ , then  $\frac{a^3 + b^3 + c^3}{abc} =$  [IIT 1982; MNR 1983]  
 (a) 1 (b) 2 (c) 3 (d) None of these
349. If the equation  $x^2 + px + q = 0$  and  $x^2 + qx + p = 0$ , have a common root, then  $p + q + 1 =$  [Orissa JEE 2002]  
 (a) 0 (b) 1 (c) 2 (d) -1

**Advance Level**

350. If every pair from among the equation  $x^2 + px + qr = 0$ ,  $x^2 + qx + rp = 0$  and  $x^2 + rx + pq = 0$  has a common root, then the product of three common roots is  
 (a)  $pqr$  (b)  $2pqr$  (c)  $p^2q^2r^2$  (d) None of these
351. If the equation  $x^2 + px + qr = 0$  and  $x^2 + qx + pr = 0$  have a common root, then the sum and product of their other roots are respectively  
 (a)  $r, pq$  (b)  $-r, pq$  (c)  $pq, r$  (d)  $-pq, r$
352. The value of 'a' for which the equations  $x^3 + ax + 1 = 0$  and  $x^4 + ax^2 + 1 = 0$  have a common root is  
 (a) 2 (b) -2 (c) 0 (d) None of these
353. If the equations  $ax^2 + bx + c = 0$  and  $cx^2 + bx + a = 0$ ,  $a \neq c$  have a negative common root then the value of  $a - b + c$  is  
 (a) 0 (b) 2 (c) 1 (d) None of these
354. If  $x^2 + ax + b = 0$  and  $x^2 + bx + a = 0$ ,  $a \neq b$ , have a common root  $\alpha$  then  
 (a)  $a + b = 1$  (b)  $\alpha + 1 = 0$  (c)  $\alpha = 1$  (d)  $a + b + 1 = 0$
355. If  $\alpha$  is a root of the equation  $2x(2x + 1) = 1$  then the other root is  
 (a)  $3\alpha^3 - 4\alpha$  (b)  $-2\alpha(\alpha + 1)$  (c)  $4\alpha^3 - 3\alpha$  (d) None of these
356. The common roots of the equations  $x^3 + 2x^2 + 2x + 1 = 0$  and  $1 + x^{130} + x^{1988} = 0$  are (where  $\omega$  is a nonreal cube root of unity)  
 (a)  $\omega$  (b)  $\omega^2$  (c) -1 (d)  $\omega - \omega^2$
357. If  $a, b, c$  are rational and no two of them are equal then the equations  $(b - c)x^2 + (c - a)x + a - b = 0$  and  $a(b - c)x^2 + b(c - a)x + c(a - b) = 0$   
 (a) Have rational roots (b) Will be such at least one has rational roots  
 (c) Have exactly one root common (d) Have at least one root common
358. If the equations  $ax^2 + bx + c = 0$  and  $x^3 + 3x^2 + 3x + 2 = 0$  have two common roots, then  
 (a)  $a = b \neq c$  (b)  $a = -b = c$  (c)  $a = b = c$  (d) None of these
359. The equations  $ax^2 + bx + a = 0$  and  $x^3 - 2x^2 + 2x - 1 = 0$  have 2 roots in common. Then  $a + b$  must be equal to  
 (a) 1 (b) -1 (c) 0 (d) None of these
360. If  $a, b, c$  are in G.P. then the equations  $ax^2 + 2bx + c = 0$  and  $dx^2 + 2ex + f = 0$  have a common root if  $\frac{d}{a}, \frac{e}{b}, \frac{f}{c}$  are in  
 [IIT 1985; Pb. CET 2000; DCE 2000]  
 (a) A.P. (b) G.P. (c) H.P. (d) None of these
361. If the equations  $x^2 + ix + a = 0$ ,  $x^2 - 2x + ia = 0$ ,  $a \neq 0$  have a common root then  
 (a)  $a$  is real (b)  $a = \frac{1}{2} + i$   
 (c)  $a = \frac{1}{2} - i$  (d) The other root is also common
362. If  $x^2 - 2r.p_r.x + r = 0$ ;  $r = 1, 2, 3$  are three quadratic equations of which each pair has exactly one root common then the number of solutions of the triplet  $(p_1, p_2, p_3)$  is  
 (a) 2 (b) 1 (c) 9 (d) 27
363. If  $x, y, z$  are three consecutive terms of a G.P., where  $x > 0$  and the common ratio is  $r$ , then the inequality  $z + 3x > 4y$  holds for

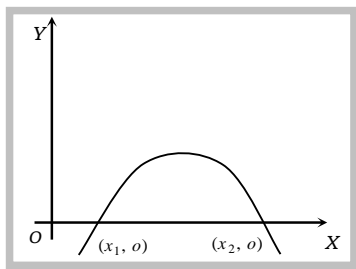
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- (a)  $r \in (-\infty, 1)$                       (b)  $r = \frac{24}{5}$                       (c)  $r \in (3, +\infty)$                       (d)  $r = \frac{1}{2}$
364. If  $x$  is real, then the value of  $x^2 - 6x + 13$  will not be less than [Rajasthan PET 1986]  
 (a) 4                      (b) 6                      (c) 7                      (d) 8
365. If  $x$  be real, the least value of  $x^2 - 6x + 10$  is [Kurukshetra CEE 1998]  
 (a) 1                      (b) 2                      (c) 3                      (d) 10
366. The smallest value of  $x^2 - 3x + 3$  in the interval  $(-3, 3/2)$  is [EAMCET 1991]  
 (a)  $3/4$                       (b) 5                      (c) -15                      (d) -20
367. If  $x = 2 + 2^{1/3} + 2^{2/3}$ , then  $x^3 - 6x^2 + 6x$  equals [Rajasthan PET 1995; MNR 1985]  
 (a) 2                      (b) -2                      (c) 0                      (d) 1
368. If  $x$  be real, then the minimum value of  $x^2 - 8x + 17$  is [MNR 1980]  
 (a) -1                      (b) 0                      (c) 1                      (d) 2
369. If  $x$  be real, then the maximum value of  $5 + 4x - 4x^2$  will be equal to [MNR 1979]  
 (a) 5                      (b) 6                      (c) 1                      (d) 2
370. The expression  $ax^2 + bx + c$  has the same sign as of 'a' of [Kurukshetra CEE 1995]  
 (a)  $b^2 - 4ac > 0$                       (b)  $b^2 - 4ac = 0$   
 (c)  $b^2 - 4ac \leq 0$                       (d)  $b$  and  $c$  have the same sign as a.
371. The value of  $x^2 + 2bx + c$  is positive if [Roorkee 1995]  
 (a)  $b^2 - 4c > 0$                       (b)  $b^2 - 4c < 0$                       (c)  $c^2 < b$                       (d)  $b^2 < c$
372. The values of 'a' for which  $(a^2 - 1)x^2 + 2(a - 1)x + 2$  is positive for any  $x$  are [UPSEAT 2001]  
 (a)  $a \geq 1$                       (b)  $a \leq 1$                       (c)  $a > -3$                       (d)  $a < -3$  or  $a > 1$

## Quadratic Expressions

### Basic Level

373. If  $x$  is real, then the maximum and minimum values of the expression  $\frac{x^2 - 3x + 4}{x^2 + 3x + 4}$  will be [IIT 1984]  
 (a) 2, 1                      (b)  $5, \frac{1}{5}$                       (c)  $7, \frac{1}{7}$                       (d) None of these
374. If  $x$  is real, then the value of  $\frac{x^2 + 34x - 71}{x^2 + 2x - 7}$  does not lie between [Roorkee 1983, 89]  
 (a) -9 and -5                      (b) -5 and 9                      (c) 0 and 9                      (d) 5 and 9
375. The adjoining figure shows the graph of  $y = ax^2 + bx + c$ . Then



- (a)  $a < 0$                       (b)  $b^2 < 4ac$   
 (c)  $c > 0$                       (d)  $a$  and  $b$  are of opposite signs
376. If  $x + 2$  is a common factor of  $px^2 + qx + r$  and  $qx^2 + px + r$ , then  
 (a)  $p = q = r$                       (b)  $p = q$  or  $p + q + r = 0$                       (c)  $p = r$  or  $p + q + r = 0$                       (d)  $q = r$  or  $p + q + r = 0$
377.  $x^2 - 11x + a$  and  $x^2 - 14x + 2a$  will have a common factor, if  $a =$  [Roorkee 1981]



- (a) 24                                      (b) 0, 24                                      (c) 3, 24                                      (d) 0, 3
378. If  $x^2 - 3x + 2$  is a factor of  $x^4 - px^2 + q$ , then [IIT 1974; MP PET 1995]  
 (a)  $p = 4, q = 5$                                       (b)  $p = 5, q = 4$                                       (c)  $p = -5, q = -4$                                       (d) None of these
379. If  $x + 1$  is a factor of  $x^4 - (p - 3)x^3 - (3p - 5)x^2 + (2p - 7)x + 6$ , then  $p$  is equal to [IIT 1975]  
 (a) -4                                      (b) 4                                      (c) -1                                      (d) 1
380. If  $x^2 + px + 1$  is a factor of the expression  $ax^3 + bx + c$ , then [IIT 1980]  
 (a)  $a^2 + c^2 = -ab$                                       (b)  $a^2 - c^2 = -ab$                                       (c)  $a^2 - c^2 = ab$                                       (d) None of these
381. The condition that  $x^3 - 3px + 2q$  may be divisible by a factor of the form  $x^2 + 2ax + a^2$  is [AMU 2002]  
 (a)  $3p = 2q$                                       (b)  $3p + 2q = 0$                                       (c)  $p^3 = q^2$                                       (d)  $27p^3 = 4q^2$
382. If  $x$  be real then  $\frac{(x-a)(x-b)}{x-c}$  will take all real values when [IIT 1984; Karnataka CET 2002]  
 (a)  $a < b < c$                                       (b)  $a > b > c$                                       (c)  $a < c < b$                                       (d) Always
383. Let  $y = \sqrt{\frac{(x+1)(x-3)}{(x-2)}}$ , then all real values of  $x$  for which  $y$  takes real values, are [IIT 1980]  
 (a)  $-1 \leq x < 2$  or  $x \geq 3$                                       (b)  $-1 \leq x < 3$  or  $x > 2$                                       (c)  $1 \leq x < 2$  or  $x \geq 3$                                       (d) None of these
384. The graph of the curve  $x^2 = 3x - y - 2$  is  
 (a) Between the lines  $x = 1$  and  $x = \frac{3}{2}$                                       (b) Between the lines  $x = 1$  and  $x = 2$   
 (c) Strictly below the line  $4y = 1$                                       (d) None of these
385. If  $x^2 + px + 1$  is a factor of the expression  $ax^3 + bx + c$  then  
 (a)  $a^2 + c^2 = -ab$                                       (b)  $a^2 - c^2 = -ab$                                       (c)  $a^2 - c^2 = ab$                                       (d) None of these
386. If  $x + \lambda y - 2$  and  $x - \mu y + 1$  are factors of the expression  $6x^2 - xy - y^2 - 6x + 8y - 12$ , then  
 (a)  $\lambda = \frac{1}{3}, \mu = \frac{1}{2}$                                       (b)  $\lambda = 2, \mu = 3$                                       (c)  $\lambda = \frac{1}{3}, \mu = -\frac{1}{2}$                                       (d) None of these

**Advance Level**

387. Given that, for all real  $x$ , the expression  $\frac{x^2 - 2x + 4}{x^2 + 2x + 4}$  lies between  $\frac{1}{3}$  and 3. The values between which the expression  $\frac{9 \cdot 3^{2x} + 6 \cdot 3^x + 4}{9 \cdot 3^{2x} - 6 \cdot 3^x + 4}$  lies are [Karnataka CET 1998]  
 (a)  $\frac{1}{3}$  and 3                                      (b) -2 and 0                                      (c) -1 and 1                                      (d) 0 and 2
388. If  $x, y, z$  are real and distinct, then  $u = x^2 + 4y^2 + 9z^2 - 6yz - 3zx - 2xy$  is always [IIT 1979]  
 (a) Non-negative                                      (b) Non-positive                                      (c) Zero                                      (d) None of these
389. If  $x + y$  and  $y + 3x$  are two factors of the expression  $\lambda x^3 - \mu x^2 y + xy^2 + y^3$ , then the third factor is  
 (a)  $y + 3x$                                       (b)  $y - 3x$                                       (c)  $y - x$                                       (d) None of these
390. If  $\log_{10} x + \log_{10} y \geq 2$  then the smallest possible value of  $x + y$  is  
 (a) 10                                      (b) 30                                      (c) 20                                      (d) None of these
391. If  $\alpha$  be the number of solutions of equation  $|\sin x| = |x|$ , where  $[x]$  denote the integral part of  $x$  and  $m$  be the greatest value of  $\cos(x^2 + xe^x - [x])$  on the interval  $[-1, 1]$ , then  
 (a)  $\alpha = m$                                       (b)  $\alpha < m$                                       (c)  $\alpha > m$                                       (d)  $\alpha \neq m$
392. If  $f(x) = 3^x + 4^x + 5^x - 6^x$ , then  $f(x) < f(3)$  for  
 (a) Only one value of  $x$                                       (b) No value of  $x$                                       (c) Only two values of  $x$                                       (d) Infinitely many values of  $x$

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393. If  $f(x) = \sum_{r=0}^{100} a_r x^r$  and  $f(0)$  and  $f(1)$  are odd numbers, then for any integer  $x$
- (a)  $f(x)$  is odd or even according as  $x$  is odd or even      (b)  $f(x)$  is even or odd according as  $x$  is odd or even  
 (c)  $f(x)$  is even for all integral values of  $x$       (d)  $f(x)$  is odd for all integral values of  $x$
394. If  $x \in [2, 4]$  then for the expression  $x^2 - 6x + 5 = 0$
- (a) The least value = -4      (b) The greatest value = 4      (c) The least value = 3      (d) The greatest value = -3
395. The value of 'a' for which  $(a^2 - 1)x^2 + 2(a - 1)x + 2$  is positive for any  $x$  are
- (a)  $a \geq 1$       (b)  $a \leq 1$       (c)  $a \geq -3$       (d)  $a \leq -3$  or  $a \geq 1$
396. Let  $f(x)$  be a quadratic expression which is positive for all real values of  $x$ , then for all real  $x$ ,  $10[f(x) + f(-x)]$  is
- (a)  $> 0$       (b)  $\geq 0$       (c)  $< 0$       (d)  $\leq 0$
397. The constant term of the quadratic expression  $\sum_{k=1}^n \left(x - \frac{1}{k+1}\right) \left(x - \frac{1}{k}\right)$  as  $n \rightarrow \infty$  is
- (a) -1      (b) 0      (c) 1      (d) None of these
398. Let  $f(x) = (1 + b^2)x^2 + 2bx + 1$  and let  $m(b)$  be the minimum value of  $f(x)$ . As  $b$  varies, the range of  $m(b)$  is
- (a)  $[0, 1]$       (b)  $\left[0, \frac{1}{2}\right]$       (c)  $\left[\frac{1}{2}, 1\right]$       (d)  $(0, 1]$
399. If  $p(x)$  be a polynomial satisfying the identity  $p(x^2) + 2x^2 + 10x = 2xp(x+1) + 3$ , then  $p(x)$  is given by
- (a)  $2x + 3$       (b)  $3x - 4$       (c)  $3x + 2$       (d)  $2x - 3$
400. Let  $y = \frac{\sin x \cos 3x}{\cos x \sin 3x}$ , then
- (a)  $y$  may be equal to  $\frac{1}{3}$       (b)  $y$  may be equal to 3  
 (c) Set of possible value of  $y$  is  $\left(-\infty, \frac{1}{3}\right) \cup (3, \infty)$       (d) Set of possible values of  $y$  is  $\left(-\infty, \frac{1}{3}\right] \cup (3, \infty)$
401. If  $a = \frac{x^2 - 2x + 4}{x^2 + 2x + 4}$ , and equation of lines  $AB$  and  $CD$  be  $3y = x$  and  $y = 3x$  respectively, then for all real  $x$ , point  $P(a, a^2)$
- (a) Lies in the acute angle between lines  $AB$  and  $CD$       (b) Lies in the obtuse angle between lines  $AB$  and  $CD$   
 (c) Cannot be in the acute angle between lines  $AB$  and  $CD$       (d) Cannot lie in the obtuse angle between lines  $AB$  and  $CD$

### Position of roots

#### Basic Level

402. If  $a, b, c$  are real numbers such that  $a + b + c = 0$ , then the quadratic equation  $3ax^2 + 2bx + c = 0$  has [MNR 1992; DCE 1995]
- (a) At least one root in  $[0, 1]$       (b) At least one root in  $[1, 2]$   
 (c) At least one root in  $[-1, 0]$       (d) None of these
403. The number of values of  $k$  for which the equation  $x^2 - 3x + k = 0$  has two real and distinct roots lying in the interval  $(0, 1)$ , are [UPSEAT 2001; Kurukshetra CEET 2002]
- (a) 0      (b) 2      (c) 3      (d) Infinitely many
404. The value of  $k$  for which the equation  $(k - 2)x^2 + 8x + k + 4 = 0$  has both real, distinct and negative is [Orissa JEE 2002]
- (a) 0      (b) 2      (c) 3      (d) -4

#### Advance Level

- 405.** Let  $a, b, c$  be real number  $a \neq 0$ . If  $\alpha$  is a root of  $a^2x^2 + bx + c = 0$ ;  $\beta$  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  $\gamma$  which always satisfies [IIT 1989]
- (a)  $\gamma = \frac{\alpha + \beta}{2}$                       (b)  $\gamma = \alpha + \frac{\beta}{2}$                       (c)  $\gamma = \alpha$                       (d)  $\alpha < \gamma < \beta$
- 406.** 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  $(0, 1)$               (c) A double root in  $(0, 2)$               (d) Two imaginary roots
- 407.** For the equation  $2x^2 + 6\sqrt{2}x + 1 = 0$
- (a) Roots are rational                      (b) If one root is  $p + \sqrt{q}$  then the other is  $-p + \sqrt{q}$   
 (c) Roots are irrational                      (d) If one root is  $p + \sqrt{q}$  then the other is  $p - \sqrt{q}$
- 408.** The values of  $a$  for which both roots of the equation  $(1 - a^2)x^2 + 2ax - 1 = 0$  lie between 0 and 1 are given by
- (a)  $a > 2$                       (b)  $1 < a < 2$                       (c)  $-\infty < a < \infty$                       (d) None of these
- 409.** If  $p, q$  be non-zero real numbers and  $f(x) \neq 0$  in  $[0, 2]$  and  $\int_0^1 f(x).(x^2 + px + q) dx = \int_0^2 f(x).(x^2 + px + q) dx = 0$  then equation  $x^2 + px + q = 0$  has
- (a) Two imaginary roots                      (b) No root in  $(0, 2)$   
 (c) One root in  $(0, 1)$  and other in  $(1, 2)$                       (d) One root in  $(-\infty, 0)$  and other in  $(2, \infty)$
- 410.** If  $a, b, c \in R, a \neq 0$  and  $(b - 1)^2 < 4ac$ , then the number of real roots of the system of equation (in three unknowns  $x_1, x_2, x_3$ )  
 $ax_1^2 + bx_1 + c = x_2, ax_2^2 + bx_2 + c = x_3, ax_3^2 + bx_3 + c = x_1$  is
- (a) 0                      (b) 1                      (c) 2                      (d) 3
- 411.** If  $0 < \alpha < \frac{\pi}{4}$ , equation  $(x - \sin \alpha)(x - \cos \alpha) - 2 = 0$  has
- (a) Both roots in  $(\sin \alpha, \cos \alpha)$                       (b) Both roots in  $(\cos \alpha, \sin \alpha)$   
 (c) One root in  $(-\infty, \cos \alpha)$  and other in  $(\sin \alpha, \infty)$                       (d) One root in  $(-\infty, \sin \alpha)$  and other in  $(\cos \alpha, \infty)$
- 412.** For equation  $x^3 - 6x^2 + 9x + k = 0$  to have exactly one root in  $(1, 3)$ , the set of values of  $k$  is
- (a)  $(-4, 0)$                       (b)  $(1, 3)$                       (c)  $(0, 4)$                       (d) None of these
- 413.** Let  $f(x) = x^3 - 6x^2 + 3(1 + \pi)x + 7, p > q > r$ , then  $\frac{\{x - f(p)\}\{x - f(r)\}}{x - f(q)}$  has no value in
- (a)  $(p, q)$                       (b)  $(q, r)$                       (c)  $(r, \infty)$                       (d) None of these
- 414.** If  $a + b + 2c = 0, c \neq 0$ , then equation  $ax^2 + bx + c = 0$  has
- (a) At least one root in  $(0, 1)$                       (b)                      At least one root in  $(0, 2)$   
 (c) At least one root in  $(-1, 1)$                       (d)                      None of these
- 415.** If  $ax^2 - bx + c = 0$  has two distinct real roots in  $(0, 1)$ , where  $a, b, c \in N$ , then  $16c(a - b + c)$
- (a)  $= a^2$                       (b)  $< a^2$                       (c)  $> a^2$                       (d)  $\geq a^2$

**Solution of Quadratic inequations**

**Basic Level**

- 416.** If  $a < b$ , then the solution of  $x^2 + (a + b)x + ab < 0$ , is given by
- (a)  $a < x < b$                       (b)  $x < a$  or  $x > b$                       (c)  $-b < x < -a$                       (d)  $x < -b$  or  $x < -a$
- 417.** The solution of  $6 + x - x^2 > 0$  is [DCE 2000; Kurakshetra CEE 1999]
- (a)  $-1 < x < 2$                       (b)  $-2 < x < 3$                       (c)  $-2 < x < -1$                       (d) None of these

## 202 Quadratic Equations and Inequalities

- 418.** For all  $x \in R$ , if  $mx^2 - 9mx + 5m + 1 > 0$ , then  $m$  lies in the interval [AMU 1989]  
 (a)  $\left(-\frac{4}{61}, 0\right)$  (b)  $\left[0, \frac{4}{61}\right)$  (c)  $\left(\frac{4}{61}, \frac{61}{4}\right)$  (d)  $\left[-\frac{61}{4}, 0\right]$
- 419.** If  $x^2 - 1$  is a factor of  $x^4 + ax^3 + 3x - b$ , then  
 (a)  $a = 3, b = -1$  (b)  $a = -3, b = 1$  (c)  $a = 3, b = 1$  (d) None of these
- 420.** If  $(x - 1)^3$  is factor of  $x^4 + ax^3 + bx^2 + cx - 1$  then the other factor is  
 (a)  $x - 3$  (b)  $x + 1$  (c)  $x + 2$  (d) None of these
- 421.** The set of values of  $x$  which satisfy  $5x + 2 < 3x + 8$  and  $\frac{x+2}{x-1} < 4$ , is [EAMCET 1989]  
 (a) (2, 3) (b)  $(-\infty, 1) \cup (2, 3)$  (c)  $(-\infty, 1)$  (d) (1, 3)
- 422.** The solution of the equation  $2x^2 + 3x - 9 \leq 0$  is given by [Kurukshetra CEE 1998]  
 (a)  $\frac{3}{2} \leq x \leq 3$  (b)  $-3 \leq x \leq \frac{3}{2}$  (c)  $-3 \leq x \leq 3$  (d)  $\frac{3}{2} \leq x \leq 2$
- 423.** The complete solution of the inequation  $x^2 - 4x < 12$  is [AMU 1999]  
 (a)  $x < -2$  or  $x > 6$  (b)  $-6 < x < 2$  (c)  $2 < x < 6$  (d)  $-2 < x < 6$
- 424.** If  $x$  is real and satisfies  $x + 2 > \sqrt{x+4}$ , then [AMU 1999]  
 (a)  $x < -2$  (b)  $x > 0$  (c)  $-3 < x < 0$  (d)  $-3 < x < 4$
- 425.** If  $a < 0$  then the inequality  $ax^2 - 2x + 4 > 0$  has the solution represented by [AMU 2001]  
 (a)  $\frac{1 + \sqrt{1-4a}}{a} > x > \frac{1 - \sqrt{1-4a}}{a}$  (b)  $x < \frac{1 - \sqrt{1-4a}}{a}$   
 (c)  $x < 2$  (d)  $2 > x > \frac{1 + \sqrt{1-4a}}{a}$

### Advance Level

- 426.** If  $x$  satisfies  $|x-1| + |x-2| + |x-3| \geq 6$ , then  
 (a)  $0 \leq x \leq 4$  (b)  $x \leq -2$  or  $x \geq 4$  (c)  $x \leq 0$  (d) None of these
- 427.** The number of positive integral solutions of  $\frac{x^2(3x-4)^3(x-2)^4}{(x-5)^5(2x-7)^6} \leq 0$  is  
 (a) 4 (b) 3 (c) 2 (d) 1
- 428.** If  $5^x + (2\sqrt{3})2^x \geq 13^x$ , then the solution set for  $x$  is  
 (a)  $[2, \infty)$  (b)  $\{2\}$  (c)  $(-\infty, 2]$  (d)  $[0, 2]$
- 429.** The inequality  $|2x - 3| < 1$  is valid when  $x$  lies in [IIT 1993]  
 (a) (3, 4) (b) (1, 2) (c) (-1, 2) (d) (-4, 3)
- 430.** The graph of the function  $y = 16x^2 + 8(a+5)x - 7a - 5$  is strictly above the  $x$ -axis, then 'a' must satisfy the inequality  
 (a)  $-15 < a < -2$  (b)  $-2 < a < -1$  (c)  $5 < a < 7$  (d) None of these
- 431.** If  $x$  is a real number such that  $x(x^2 + 1), (-1/2)x^2, 6$  are three consecutive terms of an A.P. then the next two consecutive term of the A.P. are  
 (a) 14, 6 (b) -2, -10 (c) 14, 22 (d) None of these
- 432.** If  $x, y$  are rational numbers such that  $x + y + (x - 2y)\sqrt{2} = 2x - y + (x - y - 1)\sqrt{6}$ , then  
 (a)  $x$  and  $y$  cannot be determined (b)  $x = 2, y = 1$   
 (c)  $x = 5, y = 1$  (d) None of these

433. If  $[x]$  = the greatest interger less than or equal to  $x$ , and  $(x)$  = the least interger greatest than or equal to  $x$  and  $[x]^2 + (x)^2 > 25$  then  $x$  belongs to  
 (a)  $[3, 4]$  (b)  $(-\infty, -4]$  (c)  $[4, +\infty)$  (d)  $(-\infty, -4] \cup [4, +\infty)$
434. The set of real values of  $x$  satisfying  $|x-1| \leq 3$  and  $|x-1| \geq 1$  is  
 (a)  $[2, 4]$  (b)  $(-\infty, 2] \cup [4, +\infty)$  (c)  $[-2, 0] \cup [2, 4]$  (d) None of these
435. The set of real values of  $x$  satisfying  $||x-1|-1| \leq 1$  is  
 (a)  $[-1, 3]$  (b)  $[0, 2]$  (c)  $[-1, 1]$  (d) None of these
436. If  $x \in Z$  (the set of integers) such that  $x^2 - 3x < 4$  then the number of possible values of  $x$  is  
 (a) 3 (b) 4 (c) 6 (d) None of these
437. If  $x$  is an interger satisfying  $x^2 - 6x + 5 \leq 0$  and  $x^2 - 2x > 0$  then the number of possible values of  $x$  is  
 (a) 3 (b) 4 (c) 2 (d) Infinite
438. The solution set of the ineuation  $\log_{1/3}(x^2 + x + 1) + 1 > 0$  is  
 (a)  $(-\infty, -2) \cup (1, +\infty)$  (b)  $[-1, 2]$  (c)  $(-2, 1)$  (d)  $(-\infty, +\infty)$
439. If  $3^{x/2} + 2^x > 25$  then the solution set is  
 (a)  $R$  (b)  $(2, +\infty)$  (c)  $(4, +\infty)$  (d) None of these
440. 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
441. The equation  $|x+1||x-1| = a^2 - 2a - 3$  can have real solutions for  $x$  if  $a$  belongs to  
 (a)  $(-\infty, -1] \cup [3, +\infty)$  (b)  $[1 - \sqrt{5}, 1 + \sqrt{5}]$  (c)  $[1 - \sqrt{5}, -1] \cup [3, 1 + \sqrt{5}]$  (d) None of these

Miscellaneous Problems

Basic Level

442. If  $x^2 + 2x + 2xy + my - 3$  has two rational factors, then the value of  $m$  will be [Rajasthan PET 1990]  
 (a)  $-6, -2$  (b)  $-6, 2$  (c)  $6, -2$  (d)  $6, 2$
443. If  $x^2 - hx - 21 = 0, x^2 - 3hx + 35 = 0$  ( $h > 0$ ) has a common root, then the value of  $h$  is equal to [EAMCET 1986]  
 (a) 1 (b) 2 (c) 3 (d) 4
444. Minimum value of  $(a+b+c+d)\left(\frac{1}{a} + \frac{1}{b} + \frac{1}{c} + \frac{1}{d}\right)$  is  
 (a) 4 (b) 9 (c) 16 (d) 25
445. Let  $f(x) = ax^3 + 5x^2 - bx + 1$ . If  $f(x)$  when divided by  $2x + 1$  leaves 5 as remainder, and  $f'(x)$  is divisible by  $3x - 1$  then  
 (a)  $a = 26, b = 10$  (b)  $a = 24, b = 11$  (c)  $a = 26, b = 12$  (d) None of these
446.  $x^{3^n} + y^{3^n}$  is divisible by  $x + y$  if  
 (a)  $n$  is any integer  $\geq 0$  (b)  $n$  is an odd positive integer  
 (c)  $n$  is an even positive integer (d)  $n$  is a rational number
447. The number of solution of the equation  $|x| = \cos x$  is  
 (a) One (b) Two (c) Three (d) Zero
448. The line  $y + 14 = 0$  cuts the curve whose equation is  $x(x^2 + x + 1) + y = 0$  at  
 (a) Three real points (b) One real point (c) At least one real point (d) No real point

## 204 Quadratic Equations and Inequalities

449. Let  $R$  = the set of real numbers,  $\mathbb{J}$  = the set of integers,  $N$  = the set of natural numbers. If  $S$  be the solution set of the equation  $(x)^2 + [x]^2 = (x-1)^2 + [x+1]^2$ , where  $(x)$  = the least integer greater than or equal to  $x$  and  $[x]$  = the greatest integer less than or equal to  $x$ , then
- (a)  $S = R$                       (b)  $S = R - Z$                       (c)  $S = R - N$                       (d) None of these
450. The number of real roots of  $x^8 - x^5 + x^2 - x + 1 = 0$  is equal to
- (a) 0                      (b) 2                      (c) 4                      (d) 6
451. The number of positive real roots of  $x^4 - 4x - 1 = 0$  is
- (a) 3                      (b) 2                      (c) 1                      (d) 0
452. The number of negative real roots of  $x^4 - 4x - 1 = 0$  is
- (a) 3                      (b) 2                      (c) 1                      (d) 0
453. The number of complex roots of the equation  $x^4 - 4x - 1 = 0$  is
- (a) 3                      (b) 2                      (c) 1                      (d) 0
454.  $x^2 - 4$  is a factor of  $f(x) = (a_1x^2 + b_1x + c_1)(a_2x^2 + b_2x + c_2)$  if
- (a)  $b_1 = 0, c_1 + 4a_1 = 0$                       (b)  $b_2 = 0, c_2 + 4a_2 = 0$   
(c)  $4a_1 + 2b_1 + c_1 = 0, 4a_2 + c_2 = 2b_2$                       (d)  $4a_1 + c_1 = 2b_1, 4a_2 + 2b_2 + c_2 = 0$

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# Answer Sheet

## Quadratic Equations and Inequalities

## Assignment (Basic and Advance Level)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
a	c	a	d	d	c	d	d	b	d	d	d	c	d	c	a	c	b	d	c
21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
c	d	c	c	b	c	d	c	b	c	b	c	a	a	b	c	b	b	b	c
41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
a	c	a	a	d	d	c	a	a	c	b	a	a	a	a	d	b	b	c	b
61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80
c	a	c	b	a	d	c	a	a	a	d	c	b	d	b	b	b	c	b	a
81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
d	c	b	b	b	a	c	c	b	d	b	c	b	c	b	a	b	a	a	a
101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120
c	b	c	b	a	a	a	a	c	d	c	c	b	a	c	d	b	c	b	a
121	122	123	124	125	126	127	128	129	130	131	132	133	134	135	136	137	138	139	140
d	a	a	c	c	c	d	d	c	c	b	b	b	c	b	d	d	a	a	b
141	142	143	144	145	146	147	148	149	150	151	152	153	154	155	156	157	158	159	160
a	b	a	a,c	c	b	c	a	c	b	a	b	a	d	b	d	a	a	b	b
161	162	163	164	165	166	167	168	169	170	171	172	173	174	175	176	177	178	179	180
b	c	b	b	b	a	c	c	b	b	a	b	c	d	b	b	a	a	b	d
181	182	183	184	185	186	187	188	189	190	191	192	193	194	195	196	197	198	199	200
a	a	a	c	a	c	d	b	c	d	b	d	a	c	a	a	b	a	d	d
201	202	203	204	205	206	207	208	209	210	211	212	213	214	215	216	217	218	219	220
b	c	c	c	a	d	b	d	d	c	d	c	a	a	d	a	a	d	b	a
221	222	223	224	225	226	227	228	229	230	231	232	233	234	235	236	237	238	239	240
a	b	b	b	d	c	a	d	a	a	d	c	b	a	c	b	b	c	a	d
241	242	243	244	245	246	247	248	249	250	251	252	253	254	255	256	257	258	259	260
b	b	a	c	c	b	d	b	d	c	a	c	d	b	b	b	a	b	a	a
261	262	263	264	265	266	267	268	269	270	271	272	273	274	275	276	277	278	279	280
b	a	c	a	b	a	c	a	d	b	b	b	b	a	a	a	a	b	d	a
281	282	283	284	285	286	287	288	289	290	291	292	293	294	295	296	297	298	299	300
d	a	a	c	a	b	a	b	a	a	a	a	b	d	b	d	d	d	b	c
301	302	303	304	305	306	307	308	309	310	311	312	313	314	315	316	317	318	319	320
a	b,c	a,c	b,c	b	b	b	c	b	b	d	c	b	c	a	d	b	a	d	c
321	322	323	324	325	326	327	328	329	330	331	332	333	334	335	336	337	338	339	340
a	d	b	a	c	a,c	c	b	a,c	c	a,b	c	c	a	a,b	c	c	c	d	d
341	342	343	344	345	346	347	348	349	350	351	352	353	354	355	356	357	358	359	360
c	b	b	b	c	c	c	c	a	a	b	b	a	c,d	b,c	a,b	a,c	c	c	a
361	362	363	364	365	366	367	368	369	370	371	372	373	374	375	376	377	378	379	380
c	a	a,b,c,d	a	a	a	a	c	b	c	d	d	c	d	d	b	b	b	b	c
381	382	383	384	385	386	387	388	389	390	391	392	393	394	395	396	397	398	399	400
c	c	a	c	c	a	a	a	b	c	a	d	d	a,d	d	a	c	d	a	c
401	402	403	404	405	406	407	408	409	410	411	412	413	414	415	416	417	418	419	420
d	a	a	c	d	b	b,c	a	c	a	d	a	d	a,b,c	b	c	b	b	b	b
421	422	423	424	425	426	427	428	429	430	431	432	433	434	435	436	437	438	439	440
b	b	d	b	a	c	b	c	b	a	c	b	d	a	a	a,b	a	c	c	b

441	442	443	444	445	446	447	448	449	450	451	452	453	454
a,c	c	d	c	c	a	b	b	b	a	c	c	b	a,b,c,d