QUADRATIC EQUATIONS

DPP 01

Concepts

Introduction to Quadratic Equation, Roots of a Quadratic Equation, Methods for Solving Quadratic Equations

(Based on Introduction to Quadratic Equation)

1. Which of the following is a quadratic equation ?
   (A) $x^2 + 2x + 1 = (4 - x)^2 + 3$
   (B) $-2x^2 = (5 - x)\left(2x - \frac{2}{5}\right)$
   (C) $(k + 1)x^2 + \left(\frac{3}{2}\right)x = 7$, where $k = -1$
   (D) $x^3 - x^2 = (x - 1)$
2. Which of the following is not a quadratic equation?
   (A) $2(x - 1)^2 = 4x^2 - 2x + 1$
   (B) $2x - x^2 = x^2 + 5$
   (C) $(2x + 3)^2 = 4x^2 + 5$
   (D) $(x^2 + 2x)^2 = x^4 + 3 + 4x^3$

(Based on Roots of a Quadratic Equation)

3. Find the quadratic equation whose roots are reciprocals of the roots of the equation $7x^2 - 2x + 9 = 0$.
4. Determine if -3 is a root of the equation: $\sqrt{x^2 - 4x + 3} + \sqrt{x^2 - 9} = \sqrt{4x^2 - 19x + 16}$.
5. Determine whether the given values are solutions of the given equation or not.
   (i) $x^2 - 3\sqrt{3}x + 6 = 0$; $x = \sqrt{3}$, $x = -2\sqrt{3}$
   (ii) $a^2x^2 - 3abx + 2b^2 = 0$; $x = \frac{a}{b}$, $x = \frac{b}{a}$
6. Find the value of K for which the given value of x is a solution of the equation.
   (i) $x^2 - x(a + b) + K = 0$, $x = a$
   (ii) $Kx^2 - 3abx + 2b^2 = 0$, $x = \frac{b}{a}$

(Based on Methods for Solving Quadratic Equations)

7. Solve the following quadratic equations by factorization method :
   (i) $\sqrt{3}x^2 + 10x + 7\sqrt{3} = 0$
   (ii) $\frac{1}{x-2} + \frac{2}{x-1} = \frac{6}{x}$
8. Solve the following quadratic equations by factorization method :
   (i) $x^2 - 2ax + a^2 - b^2 = 0$
   (ii) $a^2b^2x^2 + b^2x - a^2x - 1 = 0$
9. Solve the following quadratic equations by perfect square method :
   (i) $2x^2 - 3x - 5 = 0$ (ii) $-x^2 + 7x - 10 = 0$
   (iii) $x^2 + 2\sqrt{2}x - 6 = 0$ (iv) $x^2 - 3\sqrt{5}x + 10 = 0$
10. Solve the following quadratic equations by quadratic formula :
    (i) $4x^2 - 4a^2x + (a^4 - b^4) = 0$
    (ii) $9x^2 - 9(a + b)x + (2a^2 + 5ab + 2b^2) = 0$
    (iii) $x^2 + \left(\frac{a}{a+b} + \frac{a+b}{a}\right)x + 1 = 0$
    (iv) $\frac{1}{2}x^2 - \sqrt{11}x + 1 = 0$

DPP 02

Concepts

Roots of a Quadratic Equation

1. If α and β are the roots of equation in which $\alpha - \beta = -5$ and $\alpha\beta = -6$. Find the quadratic equation.
   (A) $x^2 - x - 6 = 0$ (B) $x^2 + x - 6 = 0$
   (C) $x^2 + x + 6 = 0$ (D) $x^2 - x + 6 = 0$
2. If α and β are the roots of $2x^2 - x - 2 = 0$, then $(\alpha^{-3} + \beta^{-3} + 2\alpha^{-1}\beta^{-1})$ is equal to :
   (A) $\frac{-17}{8}$ (B) $\frac{23}{6}$
   (C) $\frac{37}{9}$ (D) $\frac{-29}{8}$

3. If α and β are the roots of the quadratic equation $x^2 - 4x + 3 = 0$, then find the value of $\alpha^4\beta^3 + \alpha^3\beta^4$.
(A) 27 (B) 108
(C) –108 (D) 54

4. If sum of the squares of roots of the quadratic equation $x^2 - 8x + k = 0$ is 40, then find the value of k.
(A) 12 (B) –12
(C) 24 (D) – 24

5. If $x^2 - ax - 6 = 0$ and $x^2 + ax - 2 = 0$ have one common root, then 'a' can be:
(A) – 1 (B) 2
(C) – 3 (D) 0

6. If one of the roots of the quadratic equation is $2 + \sqrt{3}$, then find the quadratic equation:
(A) $x^2 - \left(2+\sqrt{3}\right)x + 1 = 0$
(B) $x^2 + \left(2+\sqrt{3}\right)x + 1 = 0$
(C) $x^2 - 4x + 1 = 0$
(D) $x^2 + 4x - 1 = 0$

7. If $3+\sqrt{2}$ is one root of the equation $x^2 - 6x + k = 0$, then find the value of k.
(A) k = 2 (B) k = 3
(C) k = 5 (D) k =7

8. Solve for 'x' : $3^{x+2} + 3^{-x} = 10$, where x is a whole number.
(A) –2 (B) 0
(C) Both (A) and (B) (D) 2

9. The equation $\sqrt{x+1} - \sqrt{x-1} = \sqrt{4x-1}$ has
(A) No Solution
(B) One Solution
(C) Two Solutions
(D) More than 2 Solutions

10. If $x = \dfrac{1}{2 - \dfrac{1}{2 - \dfrac{1}{2-x}}}$; where $x \neq 2$, then find x.
(A) x = 1 (B) x = 3
(C) x = 4 (D) x = 5

11. If the equations $x^2 + bx + c = 0$ and $x^2 + cx + b = 0$, $(b \neq c)$ have a common root then :
(A) b + c = 0 (B) b + c = 1
(C) b + c + 1 = 0 (D) None of these

12. If both the roots of the equations $k(6x^2 + 3) + rx + 2x^2 - 1 = 0$ and $6k(2x^2 + 1) + px + 4x^2 - 2 = 0$ are common, then 2r – p is equal to :
(A) 1 (B) – 1
(C) 2 (D) 0

13. If every pair from among the equations $x^2 + px + qr = 0$, $x^2 + qx + rp = 0$ and $x^2 + rx + pq = 0$ has a common root, then the sum of the three common roots is :
(A) 2 (p + q + r) (B) p + q + r
(C) – (p + q + r) (D) pqr

14. If $x^2 - ax - 21 = 0$ and $x^2 - 3ax + 35 = 0$; $a > 0$ have a common root, then a is equal to :
(A) 1 (B) 2
(C) 4 (D) 5

15. If the quadratic equation $2x^2 + ax + b = 0$ and $2x^2 + bx + a = 0$ $(a \neq b)$ have a common root, the value of a + b is :
(A) – 3 (B) – 2
(C) – 1 (D) 0

DPP 03

Concepts

Nature of Roots of Quadratic Equations

1. The quadratic equation $2x^2 - \sqrt{5}x + 1 = 0$ has :
(A) Two Distinct Real Roots
(B) Two Equal Real Roots
(C) No Real Roots
(D) More Than 2 Real Roots

2. Which of the following equation does not have real roots?
(A) $x^2 + 4x + 4 = 0$ (B) $x^2 + 9x + 16 = 0$
(C) $x^2 + x + 1 = 0$ (D) $x^2 + 3x + 1 = 0$

3. $(x^2 + 1)^2 - x^2 = 0$ has :
(A) Four real roots (B) Two real roots
(C) No real roots (D) One real root

4. If the roots of $(p - q)^2 x^2 + 2(p^2 - q^2)x + k = 0$ are equal, then k = ?
(A) $(p + q)^2$ (B) $(p - q)^2$
(C) $p^2 - q^2$ (D) 0

5. Find the range of values of k for which the equation $x^2 + 5kx + 16 = 0$ has no real roots.
(A) $k \in \left(-\frac{8}{5}, 0\right)$ (B) $k \in \left(0, \frac{8}{5}\right)$
(C) $k \in \left(-\frac{8}{5}, \frac{8}{5}\right)$ (D) No value possible

6. Determine the positive values of 'k' for which the equation $x^2 + kx + 64 = 0$ and $x^2 - 8x + k = 0$ will both have real roots.
   (A) 4 (B) 8
   (C) 12 (D) 16
7. If –5 is a root of the quadratic equation $2x^2 + px - 15 = 0$ and the quadratic equation $p(x^2 + x) + k = 0$ has equal roots, find the value of k.
   (A) $\frac{3}{4}$ (B) $\frac{5}{4}$
   (C) $\frac{7}{4}$ (D) $\frac{9}{4}$
8. Find the value of k for which the following equation has equal roots : $(k - 12)x^2 + 2(k - 12)x + 2 = 0$
   (A) k = 12 (B) k = 14
   (C) Both (A) and (B) (D) No value possible
9. Find the values of k for which the given equation has real and equal roots :
   (i) $x^2 + k(4x + k - 1) + 2 = 0$
   (ii) $x^2 - 2x(1 + 3k) + 7(3 + 2k) = 0$
10. Discuss the nature of roots of the following quadratic equations:
   (i) $x^2 - 3x + 4 = 0$
   (ii) $2x^2 + x - 1 = 0$
   (iii) $2x^2 - 6x + \frac{9}{2} = 0$
   (iv) $\sqrt{2}x^2 - \frac{3}{\sqrt{2}}x + \frac{1}{\sqrt{2}} = 0$

DPP 04

Concepts

Word Problems Based

1. The difference of squares of two numbers is 88. If the larger number is 5 less than twice the smaller number, then find the two numbers.
2. Some students planned a picnic. The budget for food was Rs. 480. But eight of these failed to go and thus the cost of food for each member increased by Rs. 10. How many students attended the picnic ?
3. The hypotenuse of a right triangle is $3\sqrt{10}$ cm. If the smaller leg is tripled and the longer leg doubled, new hypotenuse will be $9\sqrt{5}$ cm. How long are the legs of the triangle ?
4. A shopkeeper buys a number of books for Rs. 80. If he had bought 4 more books for the same amount, each book would have cost Rs. 1 less. How many books did he buy ?
5. One-fourth of a heard of camels was seen in the forest. Twice the square root of the herd had gone to mountains and the remaining 15 camels were seen on the bank of a river. Find the total number of camels.
6. A train covers a distance of 90 km at a uniform speed. Had the speed been 15 km/hr more, it would have taken 30 minutes less for the journey. Find the original speed of the train.
7. An aeroplane takes 1 hour less for a journey of 1200 km if its speed is increased by 100 km/hr from its usual speed. Find its usual speed.
8. A motor boat whose speed is 20 km/hr in still water, takes 1 hour more to go 448 km upstream than to return downstream to the same spot. Find the speed of the stream.
9. Two water taps together can fill a tank in 6 hours. The tap of longer diameter takes 9 hours less than the smaller one to fill the tank separately. Find the time in which each tap can separately fill the tank.
10. Two pipes running together can fill a tank in 6 minutes. If one pipe takes 5 minutes more than the other to fill the tank, find the time in which each pipe would fill the tank separately. Which pipe is better ? If electricity is used for both the pipes, then what is the moral value ?

DPP 05

Concepts

Word Problems Based

1. Two pipes running together can fill a tank in $11\frac{1}{9}$ minutes. If one pipe takes 5 minutes more than the other to fill the tank separately, find the time in which each pipe would fill the tank separately.
2. The product of Shikha's age five years ago and her age 8 years later is 30, here age at both times being given in years. Find her present age.
3. A girl is twice as old as her sister. Four years hence, the product of their ages (in years) will be 160. Find their present ages.

4. Raghu and Mohan jointly finish a piece of work in 15 days. When they work separately, Raghu takes 16 days less than the number of days spent by Mohan to finish the same piece of work. Find the number of days taken by Mohan to finish the work.
5. A takes 6 days less than the time taken by B to finish a piece of work. If both A and B together can finish it in 4 days, find the time taken by B to finish the work.
6. By increasing the list price of a book by Rs . 10 , a person can by 10 books less for Rs . 1200. Find the original list price of the book.
7. An employee has been given the responsibility to buy books for prize Distribution function. In shop A, by reducing the list price of a book by Rs. 10, the employee can buy 4 more books for Rs. 800. What is the cost of one book?
8. Seven years ago Varun's age was five times the square of Swati's age. Three years hence, Swati's age will be two fifth of Varun's age. Find their present ages.
9. Two water taps together can fill a tank in $9\frac{3}{8}$ hours.

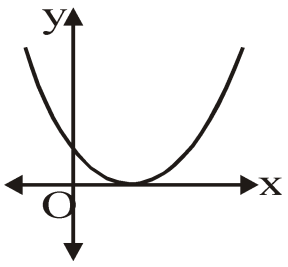
   The tap of larger diameter takes 10 hours less than the smaller one to fill the tank respectively. Find the time in which each tap can separately fill the tank.
10. A train travels 360 km at a uniform speed. If the speed had been 5 km/h more, it would have taken 1 hour less for the same journey. Find the speed of the train.
11. The length of the hypotenuse of a right triangle exceeds the length of the base by 2 cm and exceeds twice the length of the altitude by 1 cm. Find the length of each side of the triangle.

DPP 06

Concepts

Based on Geometrical mean of quadratic equation

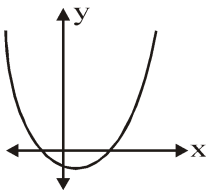
1. What does the following graph represent?



(A) Quadratic polynomial has just one root.
(B) Quadratic polynomial has equal roots.
(C) Quadratic polynomial has no root.
(D) Quadratic polynomial has equal roots and constant term is non-zero.

2. Graph of $y = ax^2 + bx + c$ is given adjacently. What conclusions can be drawn from the graph?

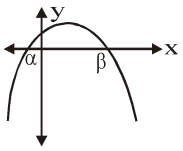
(i) $a > 0$ (ii) $b < 0$
(iii) $c < 0$ (iv) $b^2 - 4ac > 0$



(A) (i) and (iv) (B) (ii) and (iii)
(C) (i), (ii) & (iv) (D) (i), (ii), (iii) & (iv)

3. The adjoining figure shows the graph of $y = ax^2 + bx + c$. Then which of the following is correct :

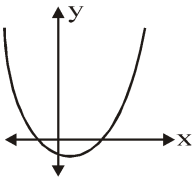
(i) $a > 0$ (ii) $b > 0$
(iii) $c > 0$ (iv) $b^2 < 4ac$



(A) (i) and (iv) (B) (ii) and (iii)
(C) (iii) & (iv) (D) None of these

4. Graph of $y = ax^2 + bx + c$ is given adjacently. What conclusions can be drawn from the graph :

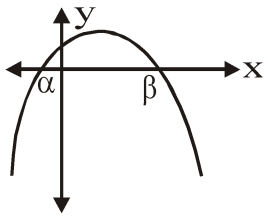
(i) $a > 0$ (ii) $b < 0$
(iii) $c < 0$ (iv) $b^2 - 4ac > 0$



(A) (i) and (iv)
(B) (ii) and (iii)
(C) (i), (ii) & (iv)
(D) (i), (ii), (iii) & (iv)

5. The adjoining figure shows the graph of $y = ax^2 + bx + c$. Then which of the following is correct:

(i) $a > 0$ (ii) $b > 0$
(iii) $c > 0$ (iv) $b^2 < 4ac$



(A) (i) and (iv) (B) (ii) and (iii)
(C) (iii) & (iv) (D) None of these

6. The expression $a^2x^2 + bx + 1$ will be positive for all $x \in R$ if :
(A) $b^2 > 4a^2$ (B) $b^2 < 4a^2$
(C) $4b^2 > a^2$ (D) $4b^2 < a^2$

7. If x be real, then $3x^2 + 14x + 11 > 0$ when :
(A) $x < -\frac{3}{2}$ (B) $x > -\frac{3}{4}$
(C) $x > -2$ (D) Never

8. For what value of a the curve $y = x^2 + ax + 25$ touches the x-axis :
(A) 0 (B) ± 5
(C) ± 10 (D) None of these

9. The integer k for which the inequality $x^2 - 2(4k - 1)x + 15k^2 - 2k - 7 > 0$ is valid for any x is :
(A) 2 (B) 3
(C) 4 (D) 6

10. The value of the expression $x^2 + 2bx + c$ will be positive for all real x if :
(A) $b^2 - 4c > 0$ (B) $b^2 - 4c < 0$
(C) $c^2 < b$ (D) $b^2 < c$

DPP 07

Concepts

NCERT EXEMPLAR

1. Which of the following is a quadratic equation?
(A) $x^2 + 2x + 1 = (4 - x)^2 + 3$
(B) $-2x^2 = (5 - x)\left(2x - \frac{2}{5}\right)$
(C) $(k + 1)x^2 + \frac{3}{2}x = 7$, where $k = -1$
(D) $x^3 - x^2 = (x - 1)^3$

2. Which of the following is not a quadratic equation?
(A) $2(x - 1)^2 = 4x^2 - 2x + 1$
(B) $2x - x^2 = x^2 + 5$
(C) $(\sqrt{2}x + \sqrt{3})^2 + x^2 = 3x^2 - 5x$
(D) $(x^2 + 2x)^2 = x^4 + 3 + 4x^3$

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

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

5. Which of the following equations has the sum of its roots as 3?
(A) $2x^2 - 3x + 6 = 0$
(B) $-x^2 + 3x - 3 = 0$
(C) $\sqrt{2}x^2 - \frac{3}{\sqrt{2}}x + 1 = 0$
(D) $3x^2 - 3x + 3 = 0$

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

7. Which constant must be added and subtracted to solve the quadratic equation $9x^2 + \frac{3}{4}x - \sqrt{2} = 0$ by the method of completing the square?
(A) $\frac{1}{8}$ (B) $\frac{1}{64}$
(C) $\frac{1}{4}$ (D) $\frac{9}{64}$

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

9. Which of the following equations has two distinct real roots?
(A) $2x^2 - 3\sqrt{2}x + \frac{9}{4} = 0$ (B) $x^2 + x - 5 = 0$
(C) $x^2 + x + 2\sqrt{2} = 0$ (D) $5x^2 - 3x + 1 = 0$

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

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

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

(C) $x^2 - 4x - 3\sqrt{2} = 0$

(D) $3x^2 + 4\sqrt{3}x + 4 = 0$

11. $(x^2 + 1)^2 - x^2 = 0$ has

(A) four real roots (B) two real roots

(C) no real roots (D) one real root.

12. Which one of th e following is not a quadratic equation?

(A) $(x + 2)^2 = 2(x + 3)$

(B) $x^2 + 3x = (-1)(1 - 3x)^2$

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

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

13. Which constant should be added and subtracted to solve the quadratic equation $4x^2 - \sqrt{3}x - 5 = 0$ by the method of completing the square?

(A) $\frac{9}{16}$ (B) $\frac{3}{16}$

(C) $\frac{3}{4}$ (D) $\frac{\sqrt{3}}{4}$

DPP 08

Concepts

NTSE PREVIOUS YEAR QUESTIONS

1. The value of x in the equation $\frac{3x+4}{2x+1} = \frac{x-8}{2x-5}$ is: **[Raj. NTSE Stage-1 2006]**

(A) – 1 (B) – 3

(C) – 4 (D) – 5

2. If one root is $3 + \sqrt{5}$, then quadratic equation will be: **[Raj. NTSE Stage-1 2006]**

(A) $x^2 + 6x - 4 = 0$ (B) $x^2 + 6x + 4 = 0$

(C) $x^2 - 6x + 4 = 0$ (D) $x^2 - 6x - 4 = 0$

3. The value of x in the equation $\frac{x-1}{x+1} = \frac{x+5}{2x+5}$ is: **[Raj. NTSE Stage-1 2007]**

(A) – 1 (B) – 5

(C) 1 (D) 5

4. If one root of quadratic equation is $\frac{1}{3-\sqrt{2}}$ then the equation will be: **[Raj. NTSE Stage-1 2007]**

(A) $7x^2 - 6x + 1 = 0$ (B) $6x^2 - 7x + 1 = 0$

(C) $x^2 - 6x + 7 = 0$ (D) $x^2 - 7x + 6 = 0$

5. If the sum of the two roots of the equation $\frac{1}{x+a} + \frac{1}{x+b} = \frac{1}{c}$ is zero, then the product of the two roots is——. **[Orissa NTSE Stage-1 2012]**

(A) 0 (B) $\frac{a^2+b^2}{2}$

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

6. Roots of $ax^2 + b = 0$ are real and distinct if : **[Orissa NTSE Stage-1 2013]**

(A) $ab > 0$ (B) $a > 0, b > 0$

(C) $ab = 0$ (D) $ab < 0$

7. If the roots of the equation $\alpha x^2 + \beta x + \gamma = 0$ are 1 and 2, then one of the roots of the equation $\beta x^2 + \alpha x + \gamma = 0$ is : **[Orissa NTSE Stage-1 2013]**

(A) 1 (B) 0

(C) – 2 (D) 2

8. If the sum of the roots of the equation $ax^2 + bx + c = 0$ is equal to product of their reciprocal then, **[MP NTSE Stage-1 2013]**

(A) $a^2 + bc = 0$ (B) $b^2 + ca = 0$

(C) $c^2 + ab = 0$ (D) $b + c = 0$

9. If one root of $x^2 - 4x + k = 0$ is 6 then the value of k is : **[MP NTSE Stage-1 2013]**

(A) – 12 (B) 2

(C) – 2 (D) 12

10. Which of the following quadratic equation has sum of their roots 4 and sum of the cubes of their roots as 28 ? **[Maharashtra NTSE Stage-1 2013]**

(A) $x^2 - 4x + 3 = 0$ (B) $x^2 - 4x - 5 = 0$

(C) $x^2 - 3x + 4 = 0$ (D) $x^2 + 4x + 3 = 0$

11. A bus takes 5 hours more than a train to cover the distance of 900 km from Vardha to Pune. If speed of the train is 15 km/hr more than that of the bus, then what is the speed of bus per hour ? **[Maharashtra NTSE Stage-1 2013]**

(A) 60 km (B) 75 km

(C) 55 km (D) 45 km

12. If $b^2 - 4ac \geq 0$ then the roots of quadratic equation $ax^2 + bx + c = 0$ is : **[Raj. NTSE Stage-1 2013]**

(A) $\frac{b}{2a} \pm \frac{\sqrt{b^2 - 4ac}}{2a}$ (B) $-\frac{b}{2a} \pm \frac{\sqrt{b^2 + 4ac}}{2a}$

(C) $\frac{b}{2a} \pm \frac{\sqrt{b^2 + 4ac}}{2a}$ (D) $-\frac{b}{2a} \pm \frac{\sqrt{b^2 - 4ac}}{2a}$

13. Graph drawn from the equation $y = x^2 - 3x - 4$ will be : **[Raj. NTSE Stage-1 2013]**

(A) Circle (B) Parabola

(C) Straight line (D) Hyperbola

14. If $\alpha + \beta = 3$ and $\alpha^3 + \beta^3 = 9$, find the quadratic equation whose roots are α and β : **[Maharashtra NTSE Stage-1 2014]**

(A) $x(x - 2) = 3$ (B) $x + \frac{2}{x} + 3 = 0$

(C) $x^2 - 2x + 3 = 0$ (D) $x + \frac{2}{x} = 3$

15. Find the sum of the cubes of the roots of the equation $3y^2 - 14y + 8 = 0$ **[Maharashtra NTSE Stage-1 2014]**

(A) $\frac{1728}{27}$ (B) $\frac{1736}{27}$

(C) $\frac{1730}{27}$ (D) $\frac{1732}{27}$

16. The number of solution of the equation $\sqrt{6 - 4x - x^2} = x + 4$ is : **[West Bengal NTSE Stage-1 2014]**

(A) 0 (B) 1

(C) 2 (D) 4

17. If $x + \frac{1}{x} = \frac{50}{7}$, then which is always true? **[Harayana NTSE Stage-1 2014]**

(A) $x^{700} > 700$

(B) $x^{700} < 700$

(C) $x^{700} > 700$ or $x^{700} < 700$

(D) $x^{700} > 700$ and $x^{700} < 700$

18. If 2 is a root of the equation $x^2 + bx + 12 = 0$ and the equation $x^2 + bx + q = 0$ has equal roots, then q = **[Raj. NTSE Stage-1 2014]**

(A) 8 (B) – 8

(C) 16 (D) – 16

19. If the roots of $px^2 + 2qx + r = 0$ and $qx^2 - 2\sqrt{pr}x + q = 0$ are simultaneously real, than **[Harayana NTSE Stage-1 2014]**

(A) p = q, r ≠ 0 (B) $2q = \sqrt{pr}$

(C) $pr = q^2$ (D) $2p = \sqrt{qr}$

20. Sum of the roots of the equation $4^x - 3(2^{x+3}) + 128 = 0$, is : **[Delhi NTSE Stage-1 2014]**

(A) 0 (B) 7

(C) 5 (D) 8

21. For the equation $3x^2 + px + 3 = 0$, if one of the roots is the square of the other then p = ... **[Jharkhand NTSE Stage-1 2014]**

(A) $\frac{1}{3}$ (B) – 1

(C) – 6 (D) $\frac{2}{3}$

22. ABCD is a rectangular such that AC + AB = 5AD and AC-AD = 8, then the area of rectangle ABCD is : **[Jharkhand NTSE Stage-1 2014]**

(A) 36 sq. units (B) 50 sq. units

(C) 60 sq. units (D) cannot be found

23. If roots of equation $2x^2 - 8x + c = 0$ are equal . Then the value of c will be **[UP NTSE Stage-1 2014]**

(A) 2 (B) 4

(C) 6 (D) 8

24. If the roots of the equation $2x^2 + ax + b = 0$ are reciprocals to each other, then the value of b is **[Raj. NTSE Stage-1 2015]**

(A) 1 (B) – 2

(C) 2 (D) 1

25. If α , β are roots of $ax^2 + bx + c = 0$ and $\alpha + k$, $\beta + k$ are roots of $px^2 + qx + r = 0$ then $\frac{b^2 - 4ac}{q^2 - 4pr} =$ ..... **[Binar NTSE Stage-1 2015]**

(A) $\frac{p^2}{a^2}$ (B) 1

(C) $\frac{a^2}{p^2}$ (D) 0

26. $\sqrt{11\sqrt{11\sqrt{11\sqrt{11.....\infty}}}} = ?$

[Delhi NTSE Stage-1 2015]

(A) $\sqrt[16]{11^{14}}$ (B) $\sqrt[16]{11^{4}}$

(C) 11 (D) $\sqrt[16]{11^{15}}$

27. If α and β are the roots of the quadratic equation $x^2 - 12x + 35 = 0$, then find the value of $2\left(\frac{\alpha}{\beta}+\frac{\beta}{\alpha}\right)$:

[Maharashtra NTSE Stage-1 2015]

(A) $\frac{74}{35}$ (B) $\frac{148}{35}$

(C) $\frac{12}{35}$ (D) $\frac{34}{35}$

28. The sum of the squares of two consecutive natural numbers is 313. Then the numbers will be

[MP NTSE Stage-1 2015]

(A) 12,13 (B) 13,–12

(C) 12,–13 (D) –12, –13

29. If the difference of two numbers is 5 and difference of their squares is 300, then sum of the numbers is **[Raj. NTSE Stage-1 2016]**

(A) 1500 (B) 6

(C) 12 (D) 60

30. If the equation $ax^2 + 2x - 2 = 0$ has real and distinct roots, then the value of a is

[Raj. NTSE Stage-1 2016]

(A) $a > \frac{-1}{2}$ (B) $a \le \frac{-1}{2}$

(C) $a \ge \frac{-1}{2}$ (D) $a = \frac{-1}{2}$

31. If the sum of two numbers is 22 and sum of their squares is 404 then the product of the number is

[Bihar NTSE Stage-1 2016]

(A) 40 (B) 44

(C) 80 (D) 88

32. If sin 87° and cos 87° are the roots of the equation $x^2 - bx + c = 0$, then the value of b^2 is :

[Haryana NTSE Stage-1 2016]

(A) c (B) 1 + 2c

(C) $1 - c^2$ (D) $1 + c^2$

33. If $\frac{x^2 - bx}{ax - c} = \frac{m-1}{m+1}$, has roots which are numerically equal but of opposite signs. the value of m must be **[Delhi NTSE Stage-1 2016]**

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

(C) c (D) $\frac{1}{c}$

34. Find the quadratic equation whose one root is $2+\sqrt{5}$ **[Maharashtra NTSE Stage-1 2016]**

(A) $x^2 - 4x + 1 = 0$

(B) $x^2 - 4x - 1 = 0$

(C) $x^2 - 4x + 3 = 0$

(D) $x^2 - 4x - 3 = 0$

35. Out of a group of Swans, $\frac{7}{2}$ times the square root of number of Swans are playing on the shore of the tank. Remaining two are quarrelling in the water. Calculate the total number of Swans. Find the number of Swans playing on the shore of the tank. **[Maharashtra NTSE Stage-1 2016]**

(A) 14, 16 (B) 16, 12

(C) 14, 12 (D) 16, 14

36. The roots of the equation: $3x^2 - 4\sqrt{3} + 4 = 0$ are :

[MP NTSE Stage-1 2016]

(A) Real & unequal

(B) Real & equal

(C) Imaginary

(D) Real & Imaginary both

37. The perimeter of a rectangular field is 82 m and area is 400 m^2. Then the breadth of the field is :

[MP NTSE Stage-1 2016]

(A) 9 m (B) 12 m

(C) 20 m (D) 25 m

38. The sum of squares of the two consecutive natural numbers is 421,the numbers are :

[MP NTSE Stage-1 2016]

(A) 14, 15 (B) 21, 22

(C) 9, 10 (D) 17, 18

39. If α and β are the roots of the quadratic equation $x^2 - 6x - 2 = 0$ and if $a_n = \alpha^n - \beta^n$, then the value of $\frac{a_{10} - 2a_8}{2a_9}$ **[NTSE Stage-2 2016]**

(A) 6.0 (B) 5.2
(C) 5.0 (D) 3.0

40. The difference between the two roots of a quadratic equation is 2 and the difference between the cubes of the roots is 98, then which of the following is that quadratic equation? **[Maharashtra NTSE Stage-1 2017]**

(A) $x^2 - 8x + 15 = 0$ (B) $x^2 + 8x - 15 = 0$
(C) $x^2 + 5x + 15 = 0$ (D) $x^2 - 5x - 15 = 0$

41. One of the root of a quadratic equation is $\left(3 - \sqrt{2}\right)$ then which of the following is that equation? **[Maharashtra NTSE Stage-1 2017]**

(A) $(x^2 - 6x - 7) = 0$ (B) $(x^2 + 6x - 7) = 0$
(C) $(x^2 + 6x + 7) = 0$ (D) $(x^2 - 6x + 7) = 0$

42. For what value of k , the equation $3x^2 + 2x + k = 0$ will have real roots : **[MP NTSE Stage-1 2017]**

(A) $k \le \frac{1}{3}$ (B) $k \ge \frac{2}{3}$
(C) $k = \frac{2}{3}$ only (D) None of these

43. The product of Meera's age 5 years ago and her age 8 years later is 30. Her present age is - **[MP NTSE Stage-1 2017]**

(A) 11 years (B) 9 years
(C) 7 years (D) 5 Years

44. The sum of the roots of quadratic equation $2x + \frac{4}{x} = 9$ is **[UP NTSE Stage-1 2017]**

(A) $\frac{7}{2}$ (B) $\frac{9}{2}$
(C) 3 (D) $\frac{-9}{2}$

45. If the roots of a quadratic equation $2x^2 + 3kx + 8 = 0$ are equal, the value of k is **[Raj. NTSE Stage-1 2017]**

(A) $\pm\frac{2}{3}$ (B) $\pm\frac{3}{2}$
(C) $\pm\frac{3}{8}$ (D) $\pm\frac{8}{3}$

46. Two quadratic equations $x^2 - bx + 6 = 0$ and $x^2 - 6x + c = 0$ have a common root. If the remaining roots of the first and second equations are positive integers and are in the ratio 3 : 4 respectively, then the common root is **[NTSE Stage- 2 2017]**

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

47. For which positive values of k and p, equations $2x^2 + px + 8 = 0$ and $p(x^2 + x) + k = 0$ have equal roots? **[Raj. NTSE Stage-1 2018]**

(A) k = 1, p = 4 (B) k = 2, p = 8
(C) k = 4, p = 8 (D) k = 2, p = 4

48. If, α, β are zeros of polynomials $x^2 - p(x + 1) - k$ such that $(\alpha + 1)(\beta + 1) = 6$, then value of k is: **[Raj. NTSE Stage-1 2018]**

(A) 5 (B) – 1
(C) – 3 (D) – 5

49. If the roots of $(b - c)x^2 + (c - a)x + (a - b) = 0$ are real and equal, then which of the following is true ? **[Raj./NTSE Stage- 1 2019]**

(A) 2b = a + c (B) 2a = b + c
(C) 2c = a + b (D) 2b = a – c

50. Discriminant of quadratic equation $2\sqrt{2}x^2 + 4x + \sqrt{2} = 0$ will be **[Raj./NTSE Stage- 1 2019]**

(A) 0 (B) 1
(C) 2 (D) 3

DPP 09

Concepts

OLYMPIAD PREVIOUS YEAR QUESTIONS

1. The quadratic equation $ax^2 + bx + c = 0$ has real roots α and β. If a, b, c real and of the same sign, then : **[IAO 2007]**
   (A) α and β are both positive
   (B) α and β are both negative
   (C) α and β are of opposite sign
   (D) nothing can be said about the signs of α and β as the information is insufficient.
2. Let α, β and γ be the roots of the equation $(x-1)(x^2 + x - 3) = 0$. Then, the value of $(\alpha + \beta)$ is : **[IAO 2007]**

   (A) – 1 (B) 0
   (C) 3 (D) 2

3. $(2x^2 + 3x + 5)^{1/2} + (2x^2 + 3x + 20)^{1/2} = 15$, therefore x is : **[IAO 2008]**

(A) $\left(\frac{-8}{3}\right)$ (B) $\left(\frac{14}{5}\right)$

(C) $\left(\frac{-11}{2}\right)$ (D) 4

4. Consider the equation : $\frac{11x^2+33x+15}{22x^2+33x-8} = \frac{x+3}{2x+3}$ The number of roots of this equation is : **[IAO 2008]**

(A) 4 (B) 3

(C) 2 (D) 1

5. The quadratic equation $a x^2 + bx + c = 0$ has real roots α and β. If a, b, c real and of the same sign, then : **[IJSO-2008]**

(A) α and β are both positive

(B) α and β are both negative

(C) α and β are of opposite sign

(D) Nothing can be said about the signs of α and β as the information is insufficient.

6. The GCD of the polynomials $[x^3 - 19x + 30]$ $[x^3 - 6x^2 + 11x - 6]$ is $[x^2 - 5x + 6]$. Therefore, the LCM of the given polynomials is : **[IAO 2009]**

(A) $(x^2 - 5x + 6)(x^2 - 4x - 5)$

(B) $(x^2 + 3x - 10)(x^2 - 4x + 3)$

(C) $(x^2 - 3x + 2)(x^2 + 2x - 15)$

(D) $(x^2 + 4x - 5)(x^2 - 5x + 6)$

7. If $x = 1 + \cfrac{1}{x + \cfrac{1}{x + \cfrac{1}{x + ----}}}$, then the value of x will be :

[IAO 2009]

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

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

8. $(2x^2 + 3x + 5)^{1/2} + (2x^2 + 3x + 20)^{1/2} = 15$, therefore x is : **[IJSO-2009]**

(A) $\frac{m}{1+m^2}$ (B) $\left(\frac{14}{5}\right)$

(C) $\left(\frac{-11}{2}\right)$ (D) 4

9. Solve for x, given $y = x^2 - 1$ and $x = 2y + 1$. **[NSTSE 2009]**

(A) $x \in \{0, 1\}$ (B) $x \in \left\{\frac{-1}{2}, \frac{-3}{4}\right\}$

(C) $x \in \left\{\frac{-1}{2}, 1\right\}$ (D) $x \in \left\{0, \frac{-3}{4}\right\}$

10. Find the sum of all values of "x", so that $16^{(x^2+3x-1)} = 8^{(x^2+3x+2)}$. **[NSTSE 2009]**

(A) 0 (B) 3

(C) – 3 (D) – 5

11. The product of the roots of the equation $\sqrt[3]{8+x} + \sqrt[3]{8-x} = 1$ is : **[IJSO-2010]**

(A) – 21 (B) – 189

(C) 9 (D) – 5

12. If α, β, γ are the roots of the equation $(x - 2)(x^2 + 6x - 11) = 0$, therefore, $(\alpha + \beta + \gamma)$ equals : **[IJSO-2010]**

(A) – 4 (B) $\frac{23}{6}$

(C) 13 (D) – 8

13. If α and β are the roots of $x^2 + p = 0$ where p is a prime, then which equation has the roots $\frac{1}{\alpha}$ & $\frac{1}{\beta}$? **[NSTSE 2010]**

(A) $\frac{1}{x^2} + \frac{1}{p} = 0$ (B) $px^2 + 1 = 0$

(C) $px^2 - 1 = 0$ (D) $\frac{1}{x^2} + \frac{1}{p} = 0$

14. Two students Ragini and Gourav were asked to solve a quadratic equation $ax^2 + bx + c = 0$, $a \neq 0$. Ragini made some mistake in writing b and found the roots as 3 and $-\frac{1}{2}$. Gourav, too made mistake in writing 'c' and found the roots – 1 and $-\frac{1}{4}$. The correct roots of the given equation should be : **[NSTSE 2010]**

(A) $-2, \frac{3}{4}$ (B) 3, – 1

(C) $-\frac{1}{2}, -1$ (D) $3, -\frac{1}{4}$

15. If one of the roots of the equation $x^2 - px + q = 0$ is m times the other root then $\frac{m}{1+m^2}$ is equal to :

[IJSO-2012]

(A) $\frac{q}{p^2-2q}$ (B) $\frac{p}{q^2-2p}$

(C) $\frac{q}{q^2-2p}$ (D) $\frac{p}{p^2-2q}$

16. Let f(x) be a quadratic polynomial with f(2) = 10 and f(–2) = –2. Then the coefficient of x in f(x) is

[IJSO-2012]

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

17. Let a, b be non-zero real numbers. Which of the following statements about the quadratic equation $ax^2 + (a + b)x + b = 0$ is neccesarily true ?

[IJSO-2013]

(I) It has at least one negative root
(II) It has at least one positive root.
(III) Both its roots are real.

(A) (I) and (II) only (B) (I) and (III) only
(C) (II) and (III) only (D) All of them

18. Let r be a root of the equation $x^2 + 2x + 6 = 0$. The value of (r + 2) (r + 3) (r + 4) (r + 5) is equal to.

[IJSO-2014]

(A) 51 (B) –51
(C) –126 (D) 126

19. Let a,b,c be non-zero real numbers such that a+b+c = 0; let $q = a^2 + b^2 + c^2$ and $r = a^4 + b^4 + c^4$ Then

[IJSO-2014]

(A) $q^2 < 2r$ always
(B) $q^2 = 2r$ always
(C) $q^2 > 2r$ always
(D) $q^2 - 2r$ can take both positive and negative value

DPP 10

Concepts

KVPY PREVIOUS YEAR QUESTIONS

1. The number of distinct pairs (x, y) of the real numbers satisfying $x = x^3 + y^4$ and $y = 2xy$ is ;

[KVPY 2007]

(A) 5 (B) 12
(C) 3 (D) 7

2. We want to find a polynomial f(x) of degree n such that $f(1) = \sqrt{2}$ and $f(3) = \pi$. Which of the following is true?

[KVPY 2007]

(A) There does not exist such a polynomial
(B) There is exactly one such polynomial and it has degree 1
(C) There are infinitely many such polynomials for each $n \geq 1$
(D) There are infinitely many such polynomials for each $n \geq 2$ but not infinitely many for n = 1

3. A polynomial p(x) when divided by $x^2 - 3x + 2$ leaves remainder 2x – 3. Then :

[KVPY 2007]

(A) p(x) must have a root between 0 and 3
(B) p(x) cannot have a root between 0 and 3
(C) p(x) must have a real root but may or may not be between 0 and 3
(D) p(x) need not have a real root

4. The number of pairs of reals (x, y) such that $x = x^2 + y^2$ and $y = 2xy$ is

[KVPY 2009]

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

5. Let $P(x) = 1 + x + x^2 + x^3 + x^4 + x^5$. What is the remainder when $P(x^{12})$ is divided by P(x) ?

[KVPY 2009]

(A) 0
(B) 6
(C) 1 + x
(D) $1 + x + x^2 + x^3 + x^4$

ANSWER KEY

DPP_01

1. D 2. C 3. $9x^2 - 2x + 7 = 0$ 4. $x = -3$ is not a root of the given equation.
5. (i) $x = \sqrt{3}$ is the solution, but $x = -2\sqrt{3}$ is not a solution of the given equation.

   (ii) $x = \frac{a}{b}$ is not the solution, but $x = \frac{b}{a}$ is a solution of the given equation.
6. (i) $K = ab$ (i) $K = a^2$
7. (i) $x = -\sqrt{3}$ or $x = -\frac{7}{\sqrt{3}}$ (ii) $x = 3$ or $x = 4$
8. (i) $x = (a + b)$ or $x = (a - b)$ (ii) $x = -\frac{1}{a^2}$ or $x = \frac{1}{b^2}$
9. (i) $x = -1$; $x = \frac{5}{2}$ (ii) $x = -5$; $x = 2$

   (iii) $x = -3\sqrt{2}$; $x = \sqrt{2}$ (iv) $x = \sqrt{5}$; $x = 2\sqrt{5}$
10. (i) $x = \frac{a^2 - b^2}{2}$ or $\frac{a^2 + b^2}{2}$ (ii) $x = \frac{a + 2b}{3}$ or $\frac{2a + b}{3}$

    (iii) $x = -\frac{(a + b)}{a}$ or $-\frac{a}{a + b}$ (iv) $x = 11 \pm \sqrt{3}$

DPP_02

1.	A	2.	D	3.	B	4.	A	5.	A	6.	C	7.	D
8.	B	9.	A	10.	A	11.	C	12.	D	13.	B	14.	B
15.	B											

DPP_03

1.	C	2.	C	3.	C	4.	A	5.	C	6.	D	7.	C

8. B 9. (i) $k = -1$ or $\frac{2}{3}$ (ii) $k = 2$ or $-\frac{10}{9}$
10. (i) No Real Roots (ii) Real and Distinct Roots

    (iii) Real and Equal Roots (iv) Real and Distinct Roots

DPP_04

1. Smaller number = 9, Larger number = 13
2. 16 students
3. 3cm, 9cm 4. 16 5. 36 6. 45km/hr
7. 300km/hr 8. 4km/hr
9. The time taken by the smaller tap to fill the tank = 18hrs & the time taken by the larger tap to fill the tank = 9hrs.
10. The time taken by the smaller pipe to fill the tank = 10min and the time taken by the greater pipe to fill the tank = 15min. Greater pipe is better because it will fill the tank early in less time so less electricity will be used that is benefical for moral value.

DPP_05

1. Time in which each pipe would fill the tank separately are 20 mins and 25 mins.
2. The present age of Shikha is 7 years.
3. Their present ages are 6 years and 12 years.

4.	24 days	5.	12 days	6.	Rs. 30	7.	Rs.50

8. Varun's present age is 27 years and Swati's present age is 9 years.
9. The larager tap takes 15 hours and the smaller tap takes 25 hours.
10. 40 km/h
11. 8 cm, 15 cm and 17 cm

DPP_06

1.	D	2.	D	3.	B	4.	D	5.	B	6.	B	7.	B
8.	C	9.	B	10.	D								

DPP_07

1.	D	2.	D	3.	C	4.	A	5.	B	6.	D	7.	B
8.	C	9.	D	10.	A	11.	C	12.	C	13.	B		

DPP_08

1.	B	2.	C	3.	D	4.	A	5.	D	6.	D	7.	A
8.	A	9.	A	10.	A	11.	D	12.	D	13.	B	14.	D
15.	B	16.	B	17.	C	18.	C	19.	C	20.	B	21.	C
22.	C	23.	D	24.	C	25.	C	26.	C	27.	B	28.	A
29.	D	30.	A	31.	A	32.	B	33.	A	34.	B	35.	D
36.	B	37.	D	38.	A	39.	D	40.	A	41.	D	42.	A
43.	C	44.	B	45.	D	46.	B,D	47.	B	48.	D	49.	A
50.	A												

DPP_09

1.	B,C,D	2.	D	3.	B	4.	D	5.	B	6.	D	7.	D
8.	C,D	9.	C	10.	C	11.	B	12.	A	13.	B		
14.	A	15.	A	16.	B	17.	A	18.	C,D	19.	D		

DPP_10

1.	A	2.	D	3.	A	4.	A	5.	B