NCERT Solutions for Class 10 Maths Chapter 4 Ex 4.4 | Updated 2026-27

⚡ **Quick Revision Box — Exercise 4.4 Nature of Roots**

- **Discriminant (D):** For $ax^2 + bx + c = 0$, discriminant $D = b^2 - 4ac$
- **D > 0:** Two distinct real roots — $x = (-b \pm \sqrt{D})/(2a)$
- **D = 0:** Two equal real roots — $x = -b/2a$
- **D < 0:** No real roots (roots are complex/imaginary)
- **Equal roots condition:** Set D = 0 and solve for the unknown (usually k)
- **Word problems:** Form the quadratic equation from given conditions, then check D
- **Exercise 4.4 has 5 questions** — all solvable using the discriminant method
- **Chapter weightage:** Quadratic Equations carries 10–12 marks in CBSE Class 10 board exam

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The **ncert solutions for class 10 maths chapter 4 ex 4 4** on this page are fully updated for the **2026-27 CBSE board exam**. Exercise 4.4 of Chapter 4 — Quadratic Equations — is one of the most important exercises in NCERT Solutions for Class 10 Maths because it tests your ability to use the discriminant to determine whether a quadratic equation has real roots, equal roots, or no real roots. All 5 questions are solved here with complete step-by-step working, LaTeX-rendered formulas, and board exam tips. You can also refer to the official NCERT textbook to cross-check the questions.

These NCERT Solutions are prepared by experienced CBSE teachers and follow the exact marking scheme expected in your board exam. Whether you need cbse class 10 maths ncert solutions for homework, revision, or last-minute exam prep, this page covers everything you need.

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Chapter Overview — Quadratic Equations Class 10 Maths (CBSE 2026-27)

Chapter 4 of the NCERT Class 10 Maths textbook is titled **Quadratic Equations**. It covers the definition of a quadratic equation, methods of solving them (factorisation, completing the square, quadratic formula), and the nature of roots using the discriminant. Exercise 4.4 specifically deals with the **nature of roots** — a concept that connects algebra to real-world problem solving.

For CBSE 2026-27 board exams, this chapter typically carries **10–12 marks**. Questions from Exercise 4.4 appear in both the 2-mark and 3-mark sections. The discriminant concept is also tested in MCQ format in the objective section. You should know how to identify the nature of roots without actually solving the equation — that is the core skill this exercise builds.

Detail	Information
Chapter	Chapter 4 — Quadratic Equations
Textbook	NCERT Mathematics (Class 10)
Exercise	Exercise 4.4
Subject	Mathematics
Board	CBSE
Academic Year	2026-27
Number of Questions	5
Difficulty Level	Medium to Hard
Key Topic	Nature of Roots using Discriminant

Key Concepts: Discriminant and Nature of Roots — Class 10 Maths

Before you solve Exercise 4.4, you must understand the **discriminant** (판별식 in Korean, but in Hindi: विविक्तकर / **D** का मान). For a quadratic equation $ax^2 + bx + c = 0$ where $a \neq 0$, the discriminant is defined as:

$$D = b^2 - 4ac$$

The value of D tells you the nature of the roots without actually solving the equation:

- **If D > 0:** The equation has **two distinct real roots**. The roots are x = (-b + √(D))/(2a) and x = (-b - √(D))/(2a).
- **If D = 0:** The equation has **two equal real roots**. Both roots equal x = -b/2a.
- **If D < 0:** The equation has **no real roots** (the roots are imaginary/complex).

Key Concept: The word "nature" of roots refers to whether they are real or imaginary, and if real, whether they are equal or distinct. This is the only thing Exercise 4.4 asks you to determine in Question 1. For Questions 2–5, you apply this knowledge to find unknown values and solve word problems.

Prerequisites for this exercise: You should be comfortable with the **quadratic formula**, **completing the square** (Exercise 4.3), and basic algebraic manipulation. If you need a refresher, check the NCERT Solutions Class 10 Maths hub for earlier exercises.

NCERT Solutions for Class 10 Maths Chapter 4 Ex 4.4 — All 5 Questions Solved

Below are complete, step-by-step solutions to all 5 questions in Exercise 4.4. These ncert solutions for class 10 maths chapter 4 ex 4 4 follow the exact method expected in CBSE board exams. Show all working in your answer sheet — partial steps carry marks.

Question 1

Medium

Find the nature of the roots of the following quadratic equations. If the real roots exist, find them:
(i) $2x^2 - 3x + 5 = 0$
(ii) $3x^2 - 4\sqrt{3}x + 4 = 0$
(iii) $2x^2 - 6x + 3 = 0$

(i) $2x^2 - 3x + 5 = 0$

Step 1: Identify the coefficients: a = 2, b = -3, c = 5.

Step 2: Calculate the discriminant:

$$D = b^2 - 4ac = (-3)^2 - 4(2)(5) = 9 - 40 = -31$$

Step 3: Since D = -31 < 0, the equation has **no real roots**.

Why does this work? The square root of a negative number is not real, so the quadratic formula gives imaginary values. There are no real solutions.

∴ **D < 0 — The equation $2x^2 - 3x + 5 = 0$ has NO real roots.**

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

Step 1: Identify the coefficients: a = 3, b = $-4\sqrt{3}$, c = 4.

Step 2: Calculate the discriminant:

$$D = b^2 - 4ac = (-4\sqrt{3})^2 - 4(3)(4) = 48 - 48 = 0$$

Step 3: Since D = 0, the equation has **two equal real roots**.

Step 4: Find the roots using x = -b/2a:

$$x = (-(-4\sqrt{3}))/(2 \times 3) = (4\sqrt{3})/(6) = (2\sqrt{3})/(3)$$

Why does this work? When D = 0, both roots are identical and equal to -b/2a. The $\pm \sqrt{D}$ term vanishes.

Verification: $3 ((2\sqrt{3})/(3))^2 - 4\sqrt{3} \cdot (2\sqrt{3})/(3) + 4 = 3 \cdot 4/3 - (8 \times 3)/(3) + 4 = 4 - 8 + 4 = 0$ ✓

∴ **D = 0 — Two equal real roots: $x = (2\sqrt{3})/(3)$ (both roots are equal)**

(iii) $2x^2 - 6x + 3 = 0$

Step 1: Identify the coefficients: a = 2, b = -6, c = 3.

Step 2: Calculate the discriminant:

$$D = b^2 - 4ac = (-6)^2 - 4(2)(3) = 36 - 24 = 12$$

Step 3: Since D = 12 > 0, the equation has **two distinct real roots**.

Step 4: Find the roots using the quadratic formula:

$$x = (-b \pm \sqrt{D})/(2a) = (6 \pm \sqrt{12})/(4) = (6 \pm 2\sqrt{3})/(4) = (3 \pm \sqrt{3})/(2)$$

Step 5: Write both roots separately:

$$x_1 = (3 + \sqrt{3})/(2), x_2 = (3 - \sqrt{3})/(2)$$

Why does this work? $\sqrt{12} = \sqrt{4 \times 3} = 2\sqrt{3}$. Simplifying the fraction by dividing numerator and denominator by 2 gives the final answer.

∴ **D > 0 — Two distinct real roots: $x = (3 + \sqrt{3})/(2)$ and $x = (3 - \sqrt{3})/(2)$**

Board Exam Note: This type of question typically appears in 2-3 mark sections of CBSE board papers. For each sub-part, you must write the discriminant calculation clearly and state the nature of roots explicitly — both steps carry marks.

Question 2

Medium

Find the values of k for each of the following quadratic equations, so that they have two equal roots.
(1) $2x^2 + kx + 3 = 0$
(2) $kx(x - 2) + 6 = 0$

(1) $2x^2 + kx + 3 = 0$

Key Concept: For two equal roots, the discriminant must equal zero: $D = b^2 - 4ac = 0$.

Step 1: Identify the coefficients: $a = 2$, $b = k$, $c = 3$.

Step 2: Set the discriminant equal to zero:

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

$$k^2 - 24 = 0$$

$$k^2 = 24$$

$$k = \pm \sqrt{24} = \pm 2\sqrt{6}$$

Why does this work? Equal roots occur when the parabola just touches the x-axis at one point, which happens exactly when $D = 0$. Any other value of k gives either two distinct roots or no real roots.

$\therefore$ $k = 2\sqrt{6}$ or $k = -2\sqrt{6}$

(2) $kx(x - 2) + 6 = 0$

Step 1: Expand the equation:

$$kx^2 - 2kx + 6 = 0$$

Step 2: Identify the coefficients: $a = k$, $b = -2k$, $c = 6$.

Step 3: For equal roots, set $D = 0$:

$$D = (-2k)^2 - 4(k)(6) = 0$$

$$4k^2 - 24k = 0$$

$$4k(k - 6) = 0$$

Step 4: Solve for k:

$$k = 0 \text{ or } k = 6$$

Step 5: Check validity. If k = 0, the equation becomes 6 = 0, which is not a quadratic equation. So k = 0 is rejected.

Why do we reject k = 0? A quadratic equation requires the coefficient of x^2 to be non-zero ($a \neq 0$). When k = 0, the equation loses its quadratic nature.

∴ **k = 6** (k = 0 is rejected as it does not give a quadratic equation)

Board Exam Note: This type of question typically appears in 2-3 mark sections of CBSE board papers. Always check whether k = 0 is valid — rejecting it with a reason earns you a mark.

Question 3

Medium

Is it possible to design a rectangular mango grove whose length is twice its breadth, and the area is 800 m^2? If so, find its length and breadth.

Step 1: Let the breadth of the rectangle be x metres. Since length is twice the breadth:

$$\text{Length} = 2x \text{ metres}$$

Step 2: Use the area formula. Area = Length × Breadth:

$$2x \times x = 800$$

$$2x^2 = 800$$

$$x^2 = 400$$

$$x^2 - 400 = 0$$

Step 3: Identify coefficients: a = 1, b = 0, c = -400. Calculate the discriminant:

$$D = b^2 - 4ac = 0 - 4(1)(-400) = 1600$$

Step 4: Since D = 1600 > 0, real roots exist. Find the roots:

$$x = (-0 \pm \sqrt{(1600)})/(2 \times 1) = (\pm 40)/(2) = \pm 20$$

Step 5: Since breadth cannot be negative, x = 20 m. Therefore, length = 2 × 20 = 40 m.

Why do we reject the negative root? Dimensions of a physical shape must be positive. A breadth of −20 m has no real-world meaning.

Verification: Area = 40 × 20 = 800 m² ✓. Length = 2 × Breadth ✓.

∴ **Yes, it is possible. Breadth = 20 m, Length = 40 m.**

Board Exam Note: This type of question typically appears in long answer sections of CBSE board papers. Always state "Yes, it is possible" or "No, it is not possible" clearly before showing working — that statement itself carries a mark.

Question 4

Hard

Is the following situation possible? If so, determine their present ages. The sum of the ages of two friends is 20 years. Four years ago, the product of their ages in years was 48.

Step 1: Let the present age of one friend be x years. Since the sum of their ages is 20:

$$\text{Present age of second friend} = (20 - x) \text{ years}$$

Step 2: Four years ago, their ages were (x - 4) and (20 - x - 4) = (16 - x) years respectively.

Step 3: Use the condition that the product of ages four years ago was 48:

$$(x - 4)(16 - x) = 48$$

$$16x - x^2 - 64 + 4x = 48$$

$$-x^2 + 20x - 64 = 48$$

$$-x^2 + 20x - 112 = 0$$

$$x^2 - 20x + 112 = 0$$

Step 4: Identify coefficients: a = 1, b = -20, c = 112. Calculate the discriminant:

$$D = b^2 - 4ac = (-20)^2 - 4(1)(112) = 400 - 448 = -48$$

Step 5: Since D = -48 < 0, the equation has **no real roots**.

What does this mean? A negative discriminant means the mathematical conditions given in the problem are contradictory — no real values of age satisfy both conditions simultaneously.

∴ **No, the situation is NOT possible.** The discriminant is negative (D = -48 < 0), so no real ages satisfy both the given conditions.

Board Exam Note: This type of question typically appears in long answer sections of CBSE board papers. Students must show the full quadratic setup and discriminant calculation to earn full marks — just writing "not possible" without working gets zero.

Question 5

Hard

Is it possible to design a rectangular park of perimeter 80 m and area 400 m²? If so, find its length and breadth.

Step 1: Let the length of the park be l metres and breadth be b metres.

Step 2: Use the perimeter condition:

$$2(l + b) = 80 \Rightarrow l + b = 40 \Rightarrow l = 40 - b$$

Step 3: Use the area condition:

$$l \times b = 400$$

$$(40 - b) \times b = 400$$

$$40b - b^2 = 400$$

$$b^2 - 40b + 400 = 0$$

Step 4: Identify coefficients: a = 1, b_coeff = -40, c = 400. Calculate the discriminant:

$$D = (-40)^2 - 4(1)(400) = 1600 - 1600 = 0$$

Step 5: Since D = 0, real roots exist and they are equal. Find the root:

$$b = (-(-40))/(2 \times 1) = 40/2 = 20 \text{ m}$$

$$l = 40 - 20 = 20 \text{ m}$$

What does D = 0 mean here? Equal roots mean both length and breadth are the same — the rectangle is actually a square. There is exactly one design possible.

Verification: Perimeter = 2(20 + 20) = 80 m ✓. Area = 20 × 20 = 400 m² ✓.

∴ **Yes, it is possible. Length = Breadth = 20 m (the park is a square).**

Board Exam Note: This type of question typically appears in long answer sections of CBSE board papers. Mention that the park is a square (since length = breadth) — this observation shows deeper understanding and can earn bonus credit.

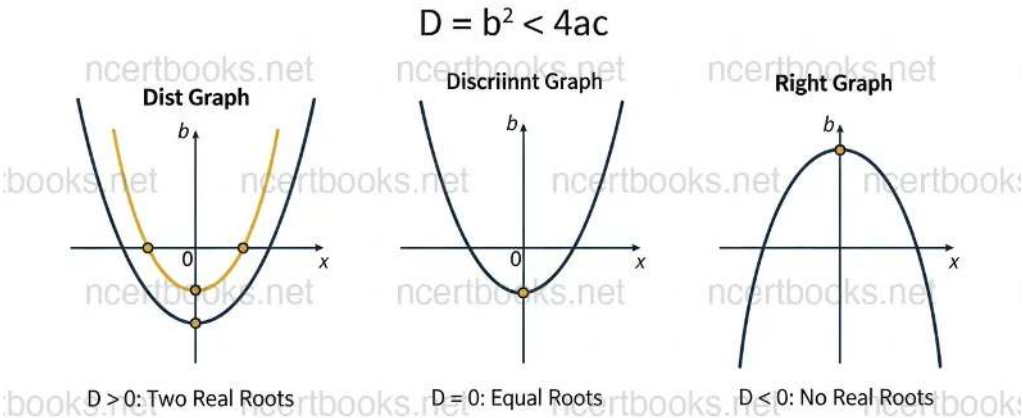

Fig 4.1: Nature of roots based on discriminant D = b² − 4ac

Formula Reference Table — Quadratic Equations Chapter 4

Formula Name	Formula	Variables Defined
Standard Form	$ax^2 + bx + c = 0$	$a \neq 0$; a, b, c are real numbers
Discriminant	$D = b^2 - 4ac$	a = coefficient of x^2, b = coefficient of x, c = constant
Quadratic Formula	$x = (-b \pm \sqrt{(D)})/(2a)$	Use when $D \geq 0$ for real roots
Equal Roots Condition	$D = 0 \Rightarrow x = -b/2a$	Both roots are equal to -b/2a
Sum of Roots	$\alpha + \beta = -b/a$	α, β are the two roots
Product of Roots	$\alpha \beta = c/a$	α, β are the two roots
Area of Rectangle	$A = l \times b$	l = length, b = breadth
Perimeter of Rectangle	$P = 2(l + b)$	l = length, b = breadth

Solved Examples Beyond NCERT — Extra Practice for Class 10 Maths

Extra Example 1 — Find k for Equal Roots

Medium

Find the value of k so that $(k+1)x^2 - 2(k-1)x + 1 = 0$ has equal roots.

Step 1: Here a = k+1, b = -2(k-1), c = 1. For equal roots, D = 0.

$$[-2(k-1)]^2 - 4(k+1)(1) = 0$$

$$4(k-1)^2 - 4(k+1) = 0$$

$$(k-1)^2 - (k+1) = 0$$

$$k^2 - 2k + 1 - k - 1 = 0$$

$$k^2 - 3k = 0$$

$$k(k-3) = 0$$

Step 2: So k = 0 or k = 3. Check: if k = 0, the equation becomes $x^2 + 2x + 1 = 0$ — still quadratic, so k = 0 is valid here.

∴ **k = 0 or k = 3**

Extra Example 2 — Nature of Roots with Parameter

Hard

For what values of p does $px^2 + 4x + 1 = 0$ have real roots?

Step 1: For real roots, D ≥ 0. Here a = p, b = 4, c = 1.

$$D = 16 - 4p \geq 0$$

$$16 \geq 4p$$

$$p \leq 4$$

Step 2: Also, for the equation to be quadratic, $p \neq 0$.

∴ **The equation has real roots when $p \leq 4$ and $p \neq 0$.**

Extra Example 3 — Age Word Problem

Medium

The sum of two numbers is 15 and the sum of their squares is 113. Find the numbers.

Step 1: Let the numbers be x and 15 - x.

$$x^2 + (15-x)^2 = 113$$

$$x^2 + 225 - 30x + x^2 = 113$$

$$2x^2 - 30x + 112 = 0$$

$$x^2 - 15x + 56 = 0$$

Step 2: Check discriminant: D = 225 - 224 = 1 > 0. Two distinct real roots exist.

$$x = (15 \pm 1)/(2) \Rightarrow x = 8 \text{ or } x = 7$$

∴ **The two numbers are 7 and 8.**

Important Questions for CBSE Board Exam 2026-27 — Chapter 4 Ex 4.4

1-Mark Questions (Definition / MCQ Type)

1. **Q:** If the discriminant of a quadratic equation is zero, what is the nature of its roots?
   A: The equation has two equal real roots.
2. **Q:** Write the discriminant of $3x^2 + 5x + 2 = 0$.
   A: D = 25 - 24 = 1
3. **Q:** For what condition does $ax^2 + bx + c = 0$ have no real roots?
   A: When $b^2 - 4ac < 0$.

3-Mark Questions

1. **Q:** Find the value of k for which $4x^2 + kx + 9 = 0$ has equal roots.
   A: For equal roots, D = 0: $k^2 - 4(4)(9) = 0 \Rightarrow k^2 = 144 \Rightarrow k = \pm 12$.
2. **Q:** Determine the nature of roots of $x^2 + 2x + 3 = 0$ without solving it.
   A: D = 4 - 12 = -8 < 0. The equation has no real roots.

5-Mark (Long Answer) Question

Q: 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 using the discriminant method to verify that real roots exist.

A: Let speed = x km/h. Time = 360/x. With increased speed: 360/x+5 = 360/x - 1. Solving: 360x - 360(x+5) = -x(x+5) ⇒ $x^2 + 5x - 1800 = 0$. Check: D = 25 + 7200 = 7225 > 0. Real roots exist. x = (-5 + 85)/(2) = 40 km/h (rejecting negative value). Speed = 40 km/h.

Common Mistakes Students Make in Exercise 4.4

Mistake 1: Students write $D = b^2 + 4ac$ instead of $b^2 - 4ac$.
Why it's wrong: The correct discriminant formula uses subtraction. Adding 4ac gives a completely different value and wrong conclusion about nature of roots.

Correct approach: Always write D = b² - 4ac and double-check the sign before substituting.

Mistake 2: In Question 2(2), students accept k = 0 as a valid answer.
Why it's wrong: When k = 0, the equation kx² - 2kx + 6 = 0 becomes 6 = 0, which is not a quadratic equation at all.
Correct approach: Always check if k = 0 makes the leading coefficient zero. If yes, reject it with a written reason.

Mistake 3: In word problems (Q3, Q5), students do not state whether the situation is possible or not.
Why it's wrong: The question specifically asks "Is it possible?" — not stating this explicitly loses marks even if the calculation is correct.
Correct approach: Start your answer with "Yes, it is possible" or "No, it is not possible" before showing any working.

Mistake 4: Students forget to reject negative values of dimensions (length, breadth) in geometry word problems.
Why it's wrong: Physical dimensions must be positive. A negative length is mathematically valid but physically meaningless.
Correct approach: After finding roots, always state "Since length/breadth cannot be negative, we reject x = negative value."

Mistake 5: In Q4 (ages problem), students set up the equation incorrectly by not subtracting 4 from both ages for "four years ago."
Why it's wrong: "Four years ago" means you subtract 4 from each person's current age. Forgetting this gives a wrong quadratic.
Correct approach: If present ages are x and 20-x, then four years ago they were x-4 and 16-x.

Exam Tips for CBSE 2026-27 — Quadratic Equations Chapter 4

🎯 CBSE 2026-27 Marking Scheme Insights

- **Show D calculation explicitly:** The CBSE 2026-27 marking scheme awards 1 mark specifically for writing and calculating the discriminant. Never skip this step.
- **State the conclusion:** After computing D, write a clear conclusion ("two distinct real roots", "two equal roots", or "no real roots"). This conclusion carries a separate mark.
- **Word problems need a "possibility statement":** In Q3, Q4, Q5-type problems, the first sentence of your answer must state whether the situation is possible or not. Examiners check this before reading your working.

- **Simplify surds fully:** In Q1(iii), √(12) = 2√(3). If you leave the answer as (6 ± √(12))/(4), you may lose a mark for incomplete simplification.
- **Chapter weightage in 2026-27:** Chapter 4 (Quadratic Equations) is part of the Algebra unit, which carries approximately 20 marks in the Class 10 CBSE board exam. Exercise 4.4-type questions appear in 2–3 mark slots.
- **Last-minute revision checklist:**
  - ✅ Memorise D = b² - 4ac and the three conditions (D>0, D=0, D<0)
  - ✅ Practise setting up quadratic equations from word problems
  - ✅ Know how to reject extraneous (negative/zero) solutions with justification
  - ✅ Revise simplification of surds (√(12), √(24), √(48))
  - ✅ Practise Q4-type age problems — they are a common CBSE favourite

Frequently Asked Questions — NCERT Solutions Class 10 Maths Chapter 4 Ex 4.4

How do you find the nature of roots of a quadratic equation using the discriminant?

To find the nature of roots, calculate D = b² - 4ac from the standard form ax² + bx + c = 0. If D > 0, the equation has two distinct real roots. If D = 0, it has two equal real roots. If D < 0, there are no real roots. This is the core concept of Exercise 4.4 and is directly tested in CBSE board exams every year.

How do you find the value of k for two equal roots in a quadratic equation?

For two equal roots, set the discriminant equal to zero: b² - 4ac = 0. Express the coefficients in terms of k, substitute into this equation, and solve for k. Always check whether any solution makes the leading coefficient zero — if it does, reject that value because the equation would no longer be quadratic. This is exactly the method used in Question 2 of Exercise 4.4.

Is it possible to design a rectangular park of perimeter 80 m and area 400 m²?

Yes, it is possible. Setting up the equations from the given perimeter and area conditions gives the quadratic b² - 40b + 400 = 0, whose discriminant is D = 1600 - 1600 = 0. Since D = 0, real roots exist and length = breadth = 20 m. The park is actually a square. This is Question 5 of Exercise 4.4 in the NCERT Class 10 Maths textbook.

Why is the ages problem in Exercise 4.4 Question 4 not possible?

The ages problem sets up the quadratic x² - 20x + 112 = 0. Its discriminant is D = 400 - 448 = -48. Since D < 0, there are no real roots, meaning no real ages satisfy both

conditions (sum = 20 and product four years ago = 48). The situation is mathematically impossible. This is a great example of how the discriminant can tell you whether a real-world problem has a valid solution.

What is the difference between no real roots and two equal roots?

When D < 0, the square root of a negative number appears in the quadratic formula, giving imaginary (complex) roots — these are called "no real roots." When D = 0, the square root term disappears and both roots are the same real number -b/2a — these are called "two equal real roots" or "repeated roots." Both cases are tested in NCERT Class 10 Maths Chapter 4 Exercise 4.4.

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