Class 10 Maths Chapter 4: Quadratic Equations - Notes, Important Questions and MCQs (2026-27)

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These Quadratic Equations Class 10 notes cover NCERT Class 10 Maths Chapter 4: the standard form, solving by factorisation and by the quadratic formula, the discriminant and nature of roots, and word problems – with solved examples, 10 MCQs and a free PDF.

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Chapter Overview

A quadratic equation in x is an equation of the form $ax^2 + bx + c = 0$, where a, b, c are real numbers and $a \neq 0$. A real number α is a root if $a\alpha^2 + b\alpha + c = 0$. A quadratic equation has at most two roots.

You solve quadratic equations by splitting the middle term (factorisation) or by the quadratic formula. The discriminant $D = b^2 - 4ac$ tells you whether the roots are real and distinct, real and equal, or not real – without solving.

Important Topics and Concepts

Standard Form and Checking a Quadratic

- Bring every term to one side and simplify: $ax^2 + bx + c = 0$, $a \neq 0$.

- Example: $(x + 1)^2 = 2(x - 3) \rightarrow x^2 + 2x + 1 - 2x + 6 = 0 \rightarrow x^2 + 7 = 0$, which is quadratic.
- $(x + 2)^3 = x^3 - 4$ simplifies to $6x^2 + 12x + 12 = 0$, so it is quadratic. But $x(x + 1) + 8 = (x + 2)(x - 2)$ simplifies to $x + 12 = 0$, which is linear.

Solving by Factorisation (Splitting the Middle Term)

- Find two numbers whose product is ac and sum is b.
- Split bx using these numbers, group and factorise.
- Set each factor equal to zero.
- Example: $2x^2 - 5x + 3 = 2x^2 - 2x - 3x + 3 = (2x - 3)(x - 1) \rightarrow x = 3/2, 1$.

Quadratic Formula

- Roots of $ax^2 + bx + c = 0$ are $x = [-b \pm \sqrt{(b^2 - 4ac)}] / 2a$, provided $b^2 - 4ac \geq 0$.
- Example: $2x^2 - 7x + 3 = 0 \rightarrow D = 49 - 24 = 25 \rightarrow x = (7 \pm 5)/4 = 3, 1/2$.
- Use the formula when factorisation is not easy.

Discriminant and Nature of Roots

- $D = b^2 - 4ac$.
- $D > 0$: two distinct real roots.
- $D = 0$: two equal real roots, each $= -b/2a$.
- $D < 0$: no real roots.

Word Problems

- Let the unknown be x and write one equation from the condition.
- Typical types: product of consecutive numbers, area of rectangles, speed–time–distance, ages, cost and number of items.
- Reject roots that do not make sense (negative lengths, ages or speeds).

Solved Examples

Board-pattern questions with full working.

- Find two consecutive positive integers whose squares sum to 365. $x^2 + (x + 1)^2 = 365 \rightarrow 2x^2 + 2x - 364 = 0 \rightarrow x^2 + x - 182 = 0 \rightarrow (x + 14)(x - 13) = 0 \rightarrow x = 13$. Integers: 13 and 14.
- Find k so that $2x^2 + kx + 3 = 0$ has equal roots. $D = k^2 - 24 = 0 \rightarrow k = \pm 2\sqrt{6}$.
- A train travels 360 km at uniform speed. If the speed were 5 km/h more, it would take 1 hour less. Find the speed. $360/x - 360/(x + 5) = 1 \rightarrow x^2 + 5x - 1800 = 0 \rightarrow (x + 45)(x - 40) = 0 \rightarrow x = 40$ km/h.
- Find the nature of the roots of $3x^2 - 4\sqrt{3}x + 4 = 0$. $D = 48 - 48 = 0 \rightarrow$ two equal real roots, each $4\sqrt{3}/6 = 2/\sqrt{3}$.

Choosing a Method

Save time in the exam.

If…	Use
ac has easy factor pairs adding to b	Factorisation
Factors are hard or roots irrational	Quadratic formula

If…	Use
Only “nature of roots” is asked	Discriminant D
Asked for k for equal roots	Set D = 0

Nature of Roots at a Glance

Discriminant $D = b^2 - 4ac$	Nature of roots	Roots
$D > 0$	Two distinct real roots	$(-b \pm \sqrt{D})/2a$
$D = 0$	Two equal real roots	$-b/2a, -b/2a$
$D < 0$	No real roots	—

Important Formulas and Definitions

Formula / Term	Meaning / Use
Quadratic equation	$ax^2 + bx + c = 0, a \neq 0$
Root / solution	Value of x satisfying the equation
Discriminant	$D = b^2 - 4ac$
Quadratic formula	$x = [-b \pm \sqrt{(b^2 - 4ac)}] / 2a$
Equal roots	Both roots are the same; happens when D = 0
Splitting the middle term	Writing bx as a sum of two terms whose coefficients multiply to ac

Short Answer Questions

Q1. Check whether $x(x + 1) + 8 = (x + 2)(x - 2)$ is a quadratic equation.

$x^2 + x + 8 = x^2 - 4 \rightarrow x + 12 = 0$, which is linear. So it is not a quadratic equation.

Q2. Solve $x^2 - 3x - 10 = 0$ by factorisation.

$(x - 5)(x + 2) = 0 \rightarrow x = 5, -2$.

Q3. Solve $2x^2 + x - 6 = 0$.

$2x^2 + 4x - 3x - 6 = (2x - 3)(x + 2) = 0 \rightarrow x = 3/2, -2$.

Q4. Find the discriminant of $2x^2 - 4x + 3 = 0$ and state the nature of roots.

$D = 16 - 24 = -8 < 0$, so there are no real roots.

Q5. Find k for which $kx(x - 2) + 6 = 0$ has equal roots.

$kx^2 - 2kx + 6 = 0$; $D = 4k^2 - 24k = 0 \rightarrow k(k - 6) = 0 \rightarrow k = 6$ ($k \neq 0$).

Q6. Find the roots of $3x^2 - 2\sqrt{6}x + 2 = 0$.

$D = 24 - 24 = 0 \rightarrow x = 2\sqrt{6}/6 = \sqrt{6}/3$ (equal roots).

Q7. The product of two consecutive positive integers is 306. Find them.

$x(x + 1) = 306 \rightarrow x^2 + x - 306 = 0 \rightarrow (x + 18)(x - 17) = 0 \rightarrow 17$ and 18.

Q8. Is it possible to design a rectangular park of perimeter 80 m and area 400 m^2? If so, find its

l + b = 40, lb = 400 → $x^2 - 40x + 400 = 0$ → $(x - 20)^2 = 0$ → l = b = 20 m. Yes, a 20 m square.

Long Answer Questions

Q1. A motor boat whose speed is 18 km/h in still water takes 1 hour more to go 24 km upstream than to return downstream. Find the speed of the stream.

Let stream speed = x km/h. Upstream speed 18 − x, downstream 18 + x.

$24/(18 - x) - 24/(18 + x) = 1$.

$24(18 + x - 18 + x) = 324 - x^2 \rightarrow 48x = 324 - x^2 \rightarrow x^2 + 48x - 324 = 0$.

$(x + 54)(x - 6) = 0 \rightarrow x = 6$ (speed cannot be negative).

Speed of the stream = 6 km/h.

Q2. The diagonal of a rectangular field is 60 m more than the shorter side. If the longer side is 30 m more than the shorter side, find the sides.

Let shorter side = x m; longer side = x + 30; diagonal = x + 60.

By Pythagoras (from Class 9 geometry): $x^2 + (x + 30)^2 = (x + 60)^2$.

$x^2 + x^2 + 60x + 900 = x^2 + 120x + 3600 \rightarrow x^2 - 60x - 2700 = 0$.

$(x - 90)(x + 30) = 0 \rightarrow x = 90$.

Sides: 90 m and 120 m.

Q3. Find the roots of $4x^2 + 4bx + (b^2 - a^2) = 0$ using the quadratic formula.

Here A = 4, B = 4b, $C = b^2 - a^2$.

$D = 16b^2 - 16(b^2 - a^2) = 16a^2$.

$x = (-4b \pm 4a)/8 = (-b \pm a)/2$.

Roots: $(a - b)/2$ and $-(a + b)/2$.

These are always real since $D = 16a^2 \geq 0$.

MCQs with Answers

1. Which is a quadratic equation?(a) $(x - 2)^2 + 1 = 2x - 3$ (b) $x^3 - x = 0$ (c) $2x + 3 = 0$ (d) $x^2 + 2x = x^2 - 1$Answer: (a) $(x - 2)^2 + 1 = 2x - 3$ – simplifies to $x^2 - 6x + 8 = 0$

2. The discriminant of $x^2 - 4x + 4 = 0$ is(a) 0 (b) 4 (c) 8 (d) 16Answer: (a) 0

3. If D < 0, the equation has(a) two equal roots (b) two distinct real roots (c) no real roots (d) one rootAnswer: (c) no real roots

4. Roots of $x^2 - 5x + 6 = 0$ are(a) 2, 3 (b) −2, −3 (c) 1, 6 (d) −1, −6Answer: (a) 2, 3

5. For equal roots of $x^2 + kx + 9 = 0$, k =(a) ±3 (b) ±6 (c) ±9 (d) 0Answer: (b) ±6 – $k^2 = 36$

6. If 1/2 is a root of $x^2 + kx - 5/4 = 0$, then k =(a) 2 (b) −2 (c) 1/4 (d) 1/2Answer: (a) 2 – 1/4 + k/2 − 5/4 = 0

7. The sum of roots of $2x^2 - 3x + 1 = 0$ is(a) 3/2 (b) −3/2 (c) 1/2 (d) −1/2Answer: (a) 3/2

9. The equation $(x + 1)^2 - x^2 = 0$ has(a) two real roots (b) one real root (c) no real root (d) infinitely manyAnswer: (b) one real root – $2x + 1 = 0$ is linear

10. A quadratic equation has at most(a) 1 root (b) 2 roots (c) 3 roots (d) infinitely manyAnswer: (b) 2 roots

Quick Revision Points

- Standard form: $ax^2 + bx + c = 0$, $a \neq 0$.
- Factorisation: split b into two numbers with product ac.
- Formula: $x = (-b \pm \sqrt{(b^2 - 4ac)})/2a$.
- $D > 0$ distinct, $D = 0$ equal $(-b/2a)$, $D < 0$ no real roots.
- Reject negative answers for lengths, speeds and ages.
- For equal roots, put $D = 0$ and solve for k.

Chapter Summary

A quadratic equation has the form $ax^2 + bx + c = 0$ with $a \neq 0$ and at most two roots. It can be solved by splitting the middle term or by the quadratic formula $x = (-b \pm \sqrt{D})/2a$.

The discriminant $D = b^2 - 4ac$ decides the nature of roots, and many word problems on numbers, areas and speeds lead to quadratic equations whose sensible root is the answer.

Exam Tips and PYQ Pattern

- A 4–5 mark word problem from this chapter is very common – form the equation carefully.
- Questions asking for k for equal roots appear almost every year.
- Always write D first and state the nature of roots in words.
- Show the factorisation step clearly; do not jump to roots.
- Completing the square is not in the 2026-27 syllabus; use factorisation or the formula.

Frequently Asked Questions

Is this chapter in the 2026-27 CBSE syllabus?

Yes. It is part of the NCERT Class 10 Mathematics textbook and the rationalised CBSE syllabus for 2026-27.

Can I download these notes as a PDF?

Yes. Use the free PDF link at the top of this page – no signup needed.

What is the discriminant of a quadratic equation?

$D = b^2 - 4ac$. It tells whether the roots are distinct real, equal real or not real.

When does a quadratic have equal roots?

When $D = 0$; each root is $-b/2a$.

Conclusion

Quadratic Equations is a high-weightage chapter. Learn the formula, the discriminant table and the word-problem setups, practise the solved examples here and save the free PDF for revision.

More Notes: Class 10 Maths Chapter 3: Pair of Linear Equations in Two Variables notes | Class 10 Maths Chapter 5: Arithmetic Progressions notes | All Class 10 Maths notes

Author Bio: Written and reviewed by the Nextoper Editorial Team, a group of CBSE mathematics educators who build chapter notes directly from the NCERT textbook and past board paper patterns.

Freshness Note: These notes follow the NCERT Class 10 Maths textbook, Mathematics (Reprint 2026-27), and the CBSE syllabus for the 2026-27 session. Last checked on 16 November 2026.