# Maths Formula Sheet

Chapter by chapter, topic by topic. Written by the PadhoNa team for quick revision.

**Unlock the full PadhoNa Test Series**
Every chapter-wise JEE Main test on the real exam screen, with full solutions and automatic analysis. Plans from ₹99 a month.
padhona.com/go/test-series →

CHAPTER 2

## Quadratic Equations

### Roots and coefficients

ROOTS

$$ax^2 + bx + c = 0 \;\Rightarrow\; x = \frac{-b \pm \sqrt{D}}{2a}, \qquad D = b^2 - 4ac$$

SUM AND PRODUCT

$$\alpha + \beta = -\frac{b}{a}, \qquad \alpha\beta = \frac{c}{a}, \qquad |\alpha - \beta| = \frac{\sqrt{D}}{|a|}$$

EQUATION FROM ROOTS

$$x^2 - (\alpha + \beta)x + \alpha\beta = 0$$

CUBIC

$$ax^3 + bx^2 + cx + d = 0: \;\; \sum \alpha = -\frac{b}{a}, \; \sum \alpha\beta = \frac{c}{a}, \; \alpha\beta\gamma = -\frac{d}{a}$$

### Nature of roots

$$D > 0 : \text{real, distinct}; \qquad D = 0 : \text{real, equal}; \qquad D < 0 : \text{non-real (conjugate pair)}$$

RATIONAL COEFFICIENTS

$$D \text{ a perfect square} \Rightarrow \text{rational roots}; \qquad \text{irrational roots occur in pairs } p \pm \sqrt{q}$$

### Common roots

ONE COMMON ROOT

$$(c_1a_2 - c_2a_1)^2 = (a_1b_2 - a_2b_1)(b_1c_2 - b_2c_1)$$

BOTH ROOTS COMMON

$$\frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2}$$

## Location of roots

VERTEX

$$f(x) = ax^2 + bx + c : \text{vertex at } x = -\frac{b}{2a}, \qquad f_{\min\,/\,\max} = -\frac{D}{4a}$$

BOTH ROOTS GREATER THAN K

$$D \geq 0, \qquad a\,f(k) > 0, \qquad -\frac{b}{2a} > k$$

BOTH ROOTS LESS THAN K

$$D \geq 0, \qquad a\,f(k) > 0, \qquad -\frac{b}{2a} < k$$

K LIES BETWEEN THE ROOTS

$$a\,f(k) < 0$$

EXACTLY ONE ROOT IN ($K_1$, $K_2$)

$$f(k_1)\,f(k_2) < 0$$

BOTH ROOTS IN ($K_1$, $K_2$)

$$D \geq 0, \;\; af(k_1) > 0, \;\; af(k_2) > 0, \;\; k_1 < -\frac{b}{2a} < k_2$$

## Sign of a quadratic

$$ax^2 + bx + c > 0\;\forall x \in \mathbb{R} \iff a > 0,\; D < 0; \qquad < 0\;\forall x \iff a < 0,\; D < 0$$

**Unlock the full PadhoNa Test Series**

Every chapter-wise JEE Main test on the real exam screen, with full solutions and automatic analysis. Plans from ₹99 a month.

**padhona.com/go/test-series →**

## Keep going with PadhoNa

**Unlock the full PadhoNa Test Series**

Every chapter-wise JEE Main test on the real exam screen, with full solutions and automatic analysis. Plans from ₹99 a month.

**padhona.com/go/test-series →**

**PadhoNa Pro Maths notes**

Complete, exam-focused Maths notes by the PadhoNa team: ₹99 for a year.

**padhona.com/go/notes/maths →**

**Physics, Chemistry and Maths notes together**

PadhoNa Pro · JEE: all three subjects for ₹249 a year, for JEE Main and Advanced.

**padhona.com/go/pro →**

© PadhoNa · padhona.com · This sheet is for personal study.