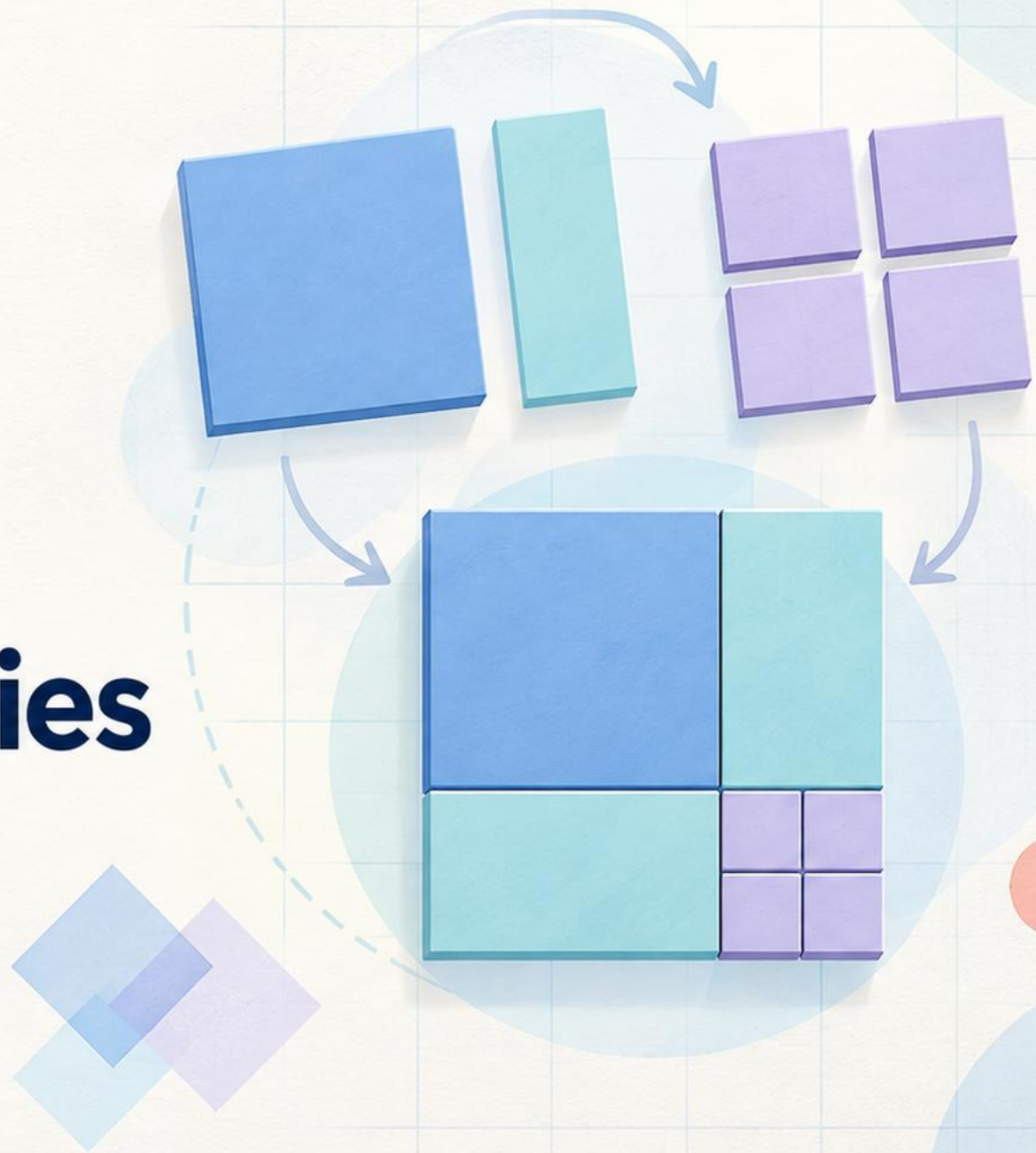


MATHEMATICS • CLASS 9

CHAPTER 4

Exploring Algebraic Identities

CHAPTER NOTES



IDENTITIES AND EQUATIONS

Meaning.

An algebraic identity is an equation that is true for every allowed value of its variables. An equation may be true only for some values.

$$(a+b)^2 = a^2 + 2ab + b^2 \quad [\text{identity}]$$

$$x^2 - 1 = 24 \quad [\text{true only when } x = 5 \text{ or } x = -5]$$

Checking a few values supports an identity, but an algebraic proof establishes it for all values.

$$a = -2, b = -3: 25 = 4 + 12 + 9.$$

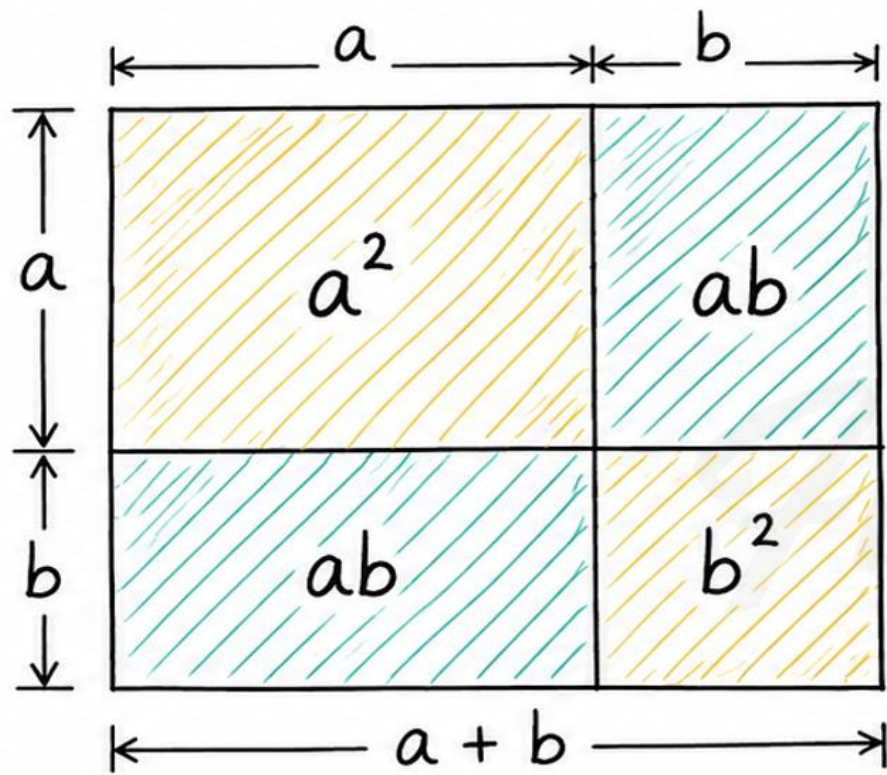
Why the square identity works.

$$\begin{aligned}(a+b)^2 &= (a+b)(a+b) \\ &= a(a+b) + b(a+b) \\ &= a^2 + ab + ab + b^2 \\ &= a^2 + 2ab + b^2\end{aligned}$$

This uses the distributive property and works for positive, negative and fractional values.

$$a = \frac{-2}{3}, b = \frac{3}{4}: (a+b)^2 = \left(\frac{1}{12}\right)^2 = \frac{1}{144}.$$

SQUARE OF A SUM



The two rectangles each have area ab .
Their combined area gives the middle term.

Do not omit the middle term.

$$(a + b)^2 - (a^2 + b^2) = 2ab$$

$$(a + b)^2 = a^2 + 2ab + b^2$$

Expanding a binomial.

$$\begin{aligned}(5x + 2y)^2 &= (5x)^2 + 2(5x)(2y) + (2y)^2 \\ &= 25x^2 + 20xy + 4y^2\end{aligned}$$

Quick calculation.

$$43^2 = (40 + 3)^2 = 1600 + 240 + 9 = 1849$$

$ab > 0$: the square of the sum is larger.

$ab < 0$: it is smaller.

$ab = 0$: the expressions are equal.

FACTORISING PERFECT SQUARES

Factorisation reverses expansion. Look for two square terms and twice their product.

$$a^2 + 2ab + b^2 = (a + b)^2$$

Example 1: $x^2 + 4x + 4 = x^2 + 2(x)(2) + 2^2 = (x + 2)^2$

The two equal factors are $x + 2$.

Example 2: $36x^2 + 12x + 1 = (6x)^2 + 2(6x)(1) + 1^2 = (6x + 1)^2$

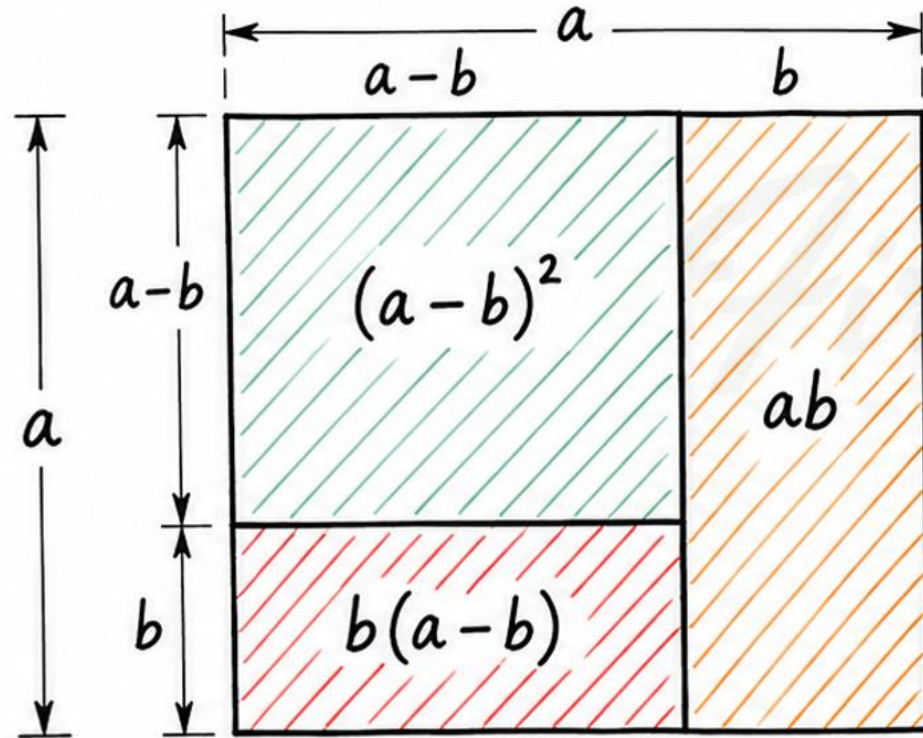
Example 3:
$$\begin{aligned} 50p^2 + 60pq + 18q^2 &= 2(25p^2 + 30pq + 9q^2) \\ &= 2[(5p)^2 + 2(5p)(3q) + (3q)^2] \\ &= 2(5p + 3q)^2 \end{aligned}$$

Take out a common factor first when it makes the square pattern easier to see.

SQUARE OF A DIFFERENCE

$$(a - b)^2 = a^2 - 2ab + b^2$$

Replace b by $-b$ in the square-of-a-sum identity.



$$(a - b)^2 = a^2 - ab - b(a - b) = a^2 - 2ab + b^2$$

Quick calculation.

$$\begin{aligned} 29^2 &= (30 - 1)^2 \\ &= 900 - 60 + 1 \\ &= 841 \end{aligned}$$

Three consecutive squares.

Add the smallest and largest squares,
then subtract twice the middle square.

$$\begin{aligned} &(n - 1)^2 + (n + 1)^2 - 2n^2 \\ &= (n^2 - 2n + 1) + (n^2 + 2n + 1) - 2n^2 \\ &= 2 \end{aligned}$$

This explains why the result is always two.



FREE PREVIEW

[Click here to visit our website](#)

SCHOOL NOTES & NCERT SOLUTIONS

Complete notes and
NCERT solutions are
available on
FirstHope app only.



[Scan or click here](#)

Click here to get the app

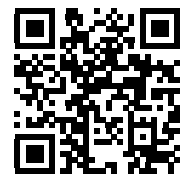


Available on Google Play

JOIN THE FIRSTHOPE COMMUNITY

Join our Telegram channel

Click here to join Telegram



[Scan or click here](#)

@FirstHope_CBSE_Notes

Instagram

@firsthope.school

[Click here to follow >](#)

YouTube channel

@firsthope.school

[Click here to watch >](#)

FirstHope website

firsthope.co.in

[Click here to visit our website >](#)

CBSE / Class 9 / Class 10 / Class 11 / Class 12

Preview notes and NCERT solutions. Full PDFs in the FirstHope app.