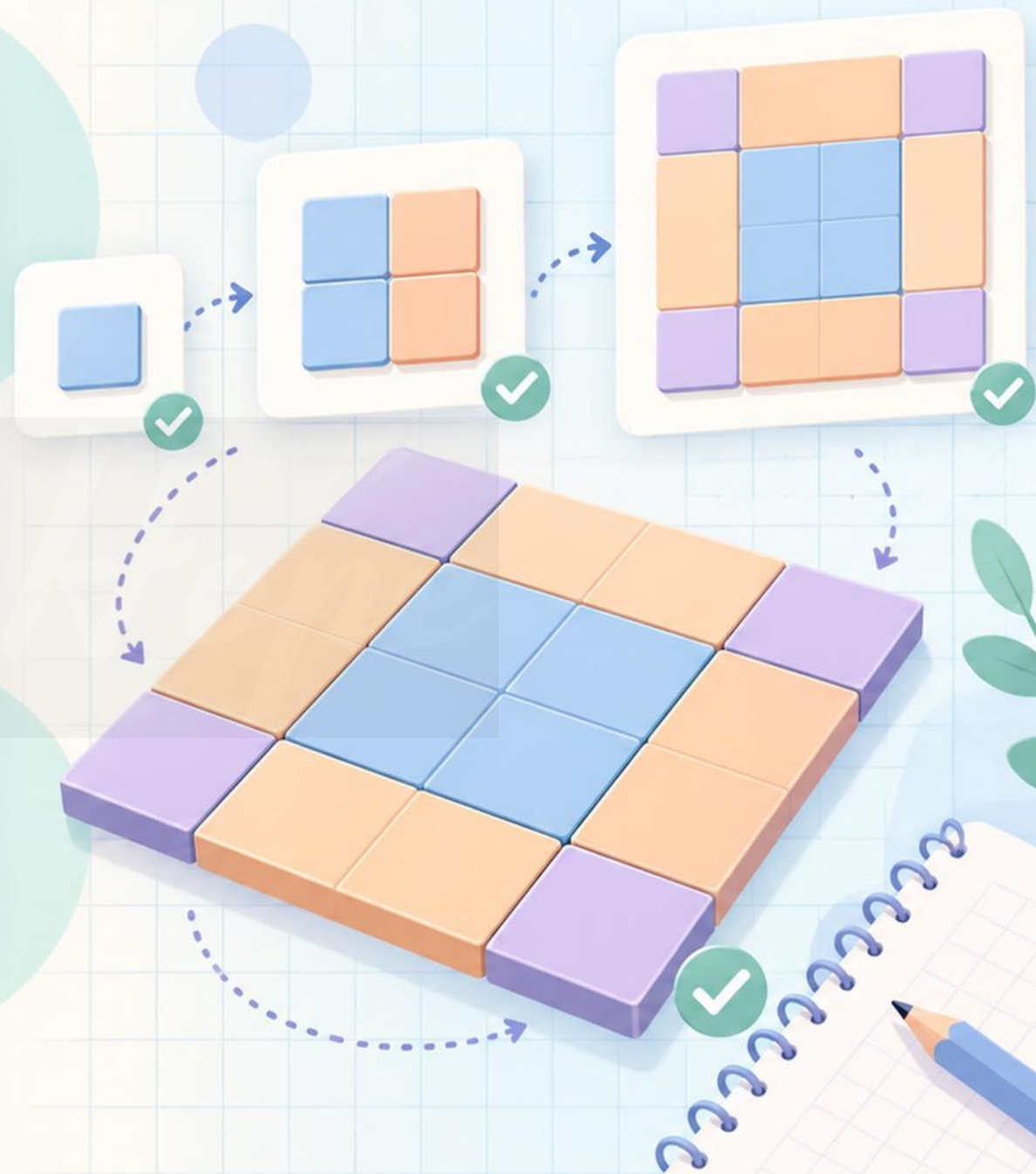


MATHEMATICS • CLASS 9

CHAPTER 4

Exploring Algebraic Identities

NCERT SOLUTIONS



CONSECUTIVE SQUARES – PATTERN

Pattern with 3 consecutive squares

Show the squares as n^2 , $(n+1)^2$, $(n+2)^2$.

outer squares – $2 \times$ middle square

$$\begin{aligned} &= n^2 + (n+2)^2 - 2(n+1)^2 \\ &= n^2 + (n^2 + 4n + 4) - 2(n^2 + 2n + 1) \\ &= 2. \end{aligned}$$

The result is always 2.

Check:

For 1^2 , 2^2 , 3^2 :

$$1 + 9 - 2(4) = 2 \quad \checkmark$$

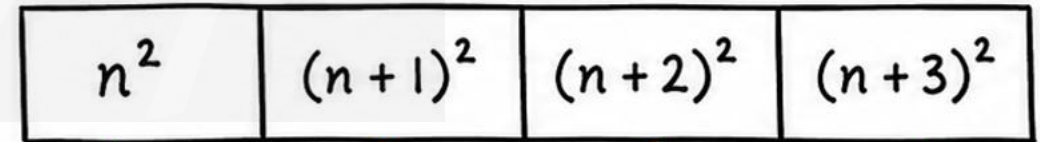
Think and Reflect: try 4 consecutive squares

Take n^2 , $(n+1)^2$, $(n+2)^2$, $(n+3)^2$.

Compare outer pair with inner pair:

$$\begin{aligned} &n^2 + (n+3)^2 - [(n+1)^2 + (n+2)^2] \\ &= n^2 + n^2 + 6n + 9 - [n^2 + 2n + 1 + n^2 + 4n + 4] \\ &= 4. \end{aligned}$$

For 4 consecutive squares, outer-pair sum – inner-pair sum = 4.



Check:

$$1 + 16 - (4 + 9) = 4.$$

WHEN IS $(a + b)^2$ BIGGER?

Think and Reflect

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

Therefore the difference is:

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

- ① $-$ When is $(a + b)^2 < a^2 + b^2$? $2ab < 0 \Rightarrow ab < 0$. a and b have opposite signs (one positive and one negative).
Example: $a = 3, b = -2$: $(3 - 2)^2 = 1 < 9 + 4 = 13$.
-
- ② $+$ When is $(a + b)^2 > a^2 + b^2$? $2ab > 0 \Rightarrow ab > 0$. a and b have the same sign (both positive or both negative).
Example: $a = 3, b = 2$: $5^2 = 25 > 9 + 4 = 13$.
-
- ③ $=$ When is $(a + b)^2 = a^2 + b^2$? $2ab = 0 \Rightarrow ab = 0 \Rightarrow a = 0$ or $b = 0$.
Example: $a = 5, b = 0$: $5^2 = 25 = 25 + 0$.

The sign of ab decides the comparison.

EXERCISE 4.1 – EXPANSION (1)

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

$$\begin{aligned}\text{(i)} \quad (7x + 4y)^2 \\ \quad \quad \uparrow \quad \quad \uparrow \\ \quad \quad a = 7x \quad b = 4y\end{aligned}$$

$$\begin{aligned}&= (7x)^2 + 2(7x)(4y) + (4y)^2 \\ &= 49x^2 + 56xy + 16y^2.\end{aligned}$$

$$\begin{aligned}\text{(ii)} \quad \left(\frac{7}{5}x + \frac{3}{2}y\right)^2 \\ \quad \quad \uparrow \quad \quad \uparrow \\ \quad \quad a = \frac{7}{5}x \quad b = \frac{3}{2}y\end{aligned}$$

$$\begin{aligned}&= \left(\frac{7}{5}x\right)^2 + 2\left(\frac{7}{5}x\right)\left(\frac{3}{2}y\right) + \left(\frac{3}{2}y\right)^2 \\ &= \frac{49}{25}x^2 + \frac{21}{5}xy + \frac{9}{4}y^2.\end{aligned}$$

$$\begin{aligned}\text{(iii)} \quad (2.5p + 1.5q)^2 \\ \quad \quad \uparrow \quad \quad \uparrow \\ \quad \quad a = 2.5p \quad b = 1.5q\end{aligned}$$

$$\begin{aligned}&= (2.5p)^2 + 2(2.5p)(1.5q) + (1.5q)^2 \\ &= 6.25p^2 + 7.5pq + 2.25q^2.\end{aligned}$$

EXERCISE 4.1 — EXPANSION (2)

$$\text{Identity: } (a+b)^2 = a^2 + 2ab + b^2$$

Solve:

$$\begin{aligned} \text{(iv)} \quad \left(\left(\frac{3}{4}\right)s + 8t\right)^2 &= \left(\left(\frac{3}{4}\right)s\right)^2 + 2\left(\left(\frac{3}{4}\right)s\right)(8t) + (8t)^2 \\ &= \left(\frac{9}{16}\right)s^2 + 12st + 64t^2. \end{aligned}$$

$$\begin{aligned} \text{(v)} \quad \left(x + \frac{1}{2y}\right)^2 &= x^2 + 2(x)\left(\frac{1}{2y}\right) + \frac{1}{4y^2} \\ &= x^2 + \frac{x}{y} + \frac{1}{4y^2}. \end{aligned}$$

$2 \times x \times \frac{1}{2y} = \frac{x}{y}$

$$\text{(vi)} \quad \left(\frac{1}{x} + \frac{1}{y}\right)^2 = \frac{1}{x^2} + \frac{2}{xy} + \frac{1}{y^2}.$$



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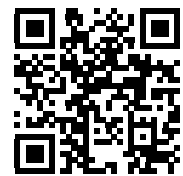


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