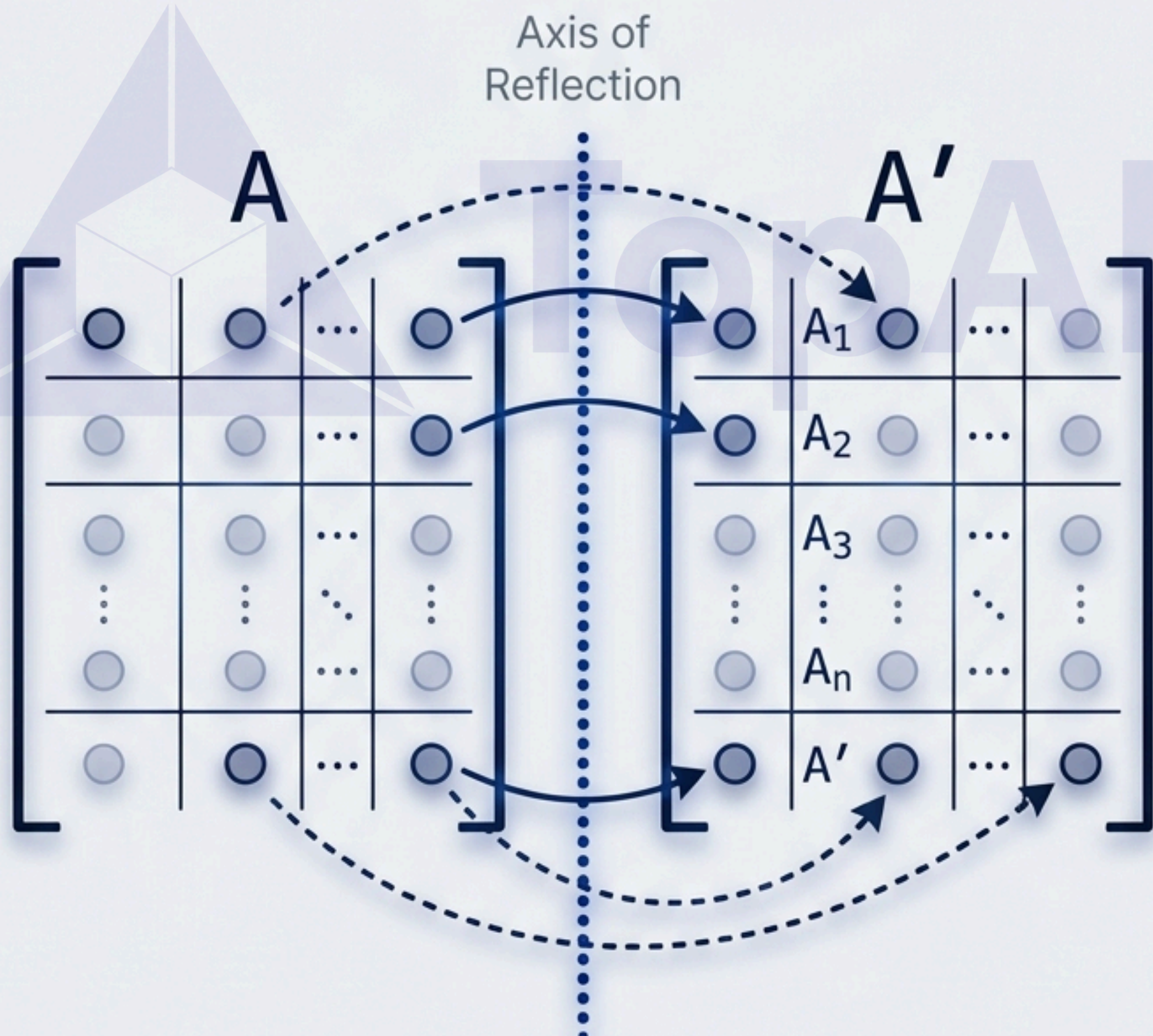


Symmetric vs. Skew-Symmetric Matrices

Understanding structural properties, the diagonal rule, and decomposition theorems.

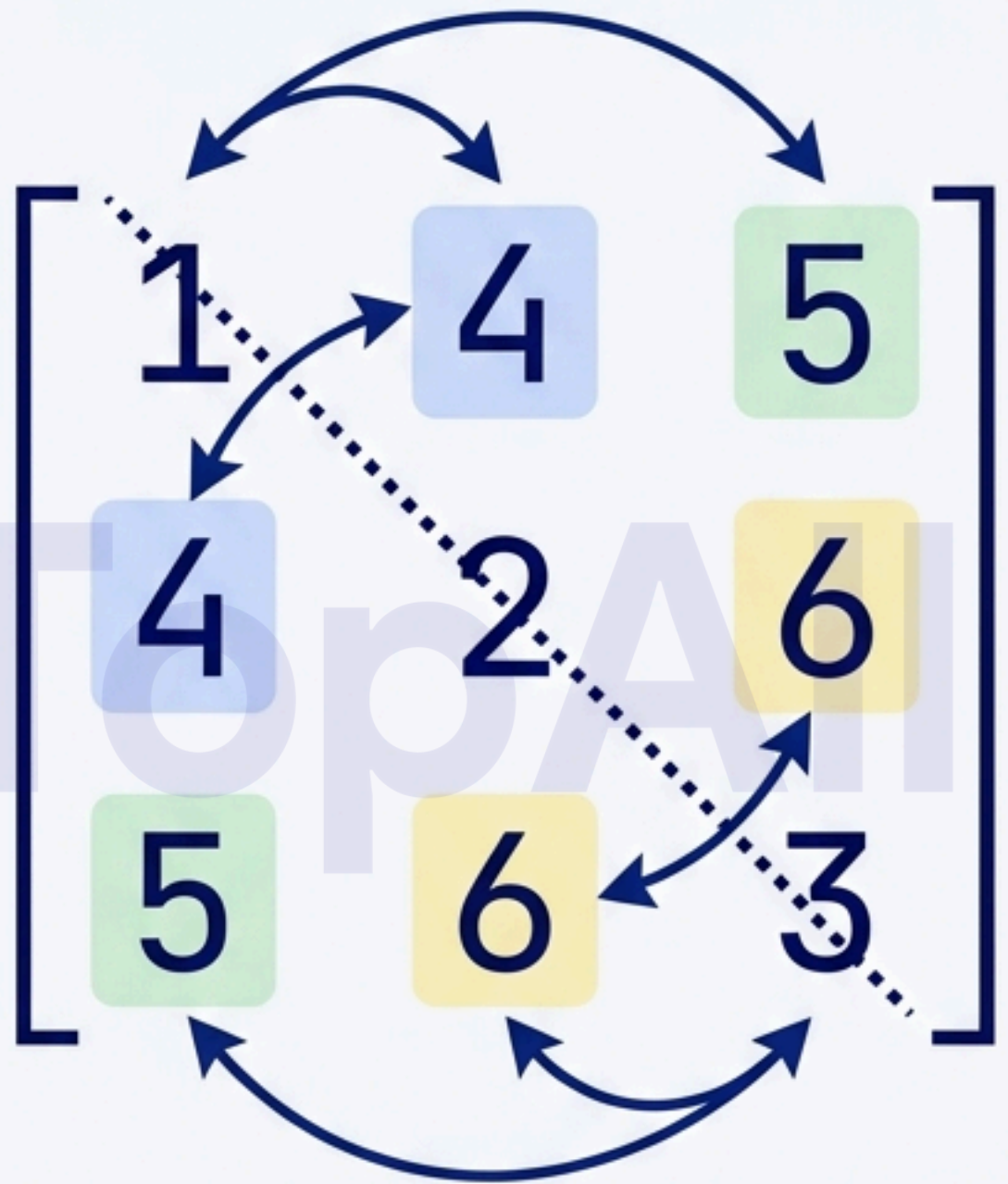


The Symmetric Matrix

$$A' = A$$

$$a_{ij} = a_{ji}$$

Mirror perfectly across the main diagonal.

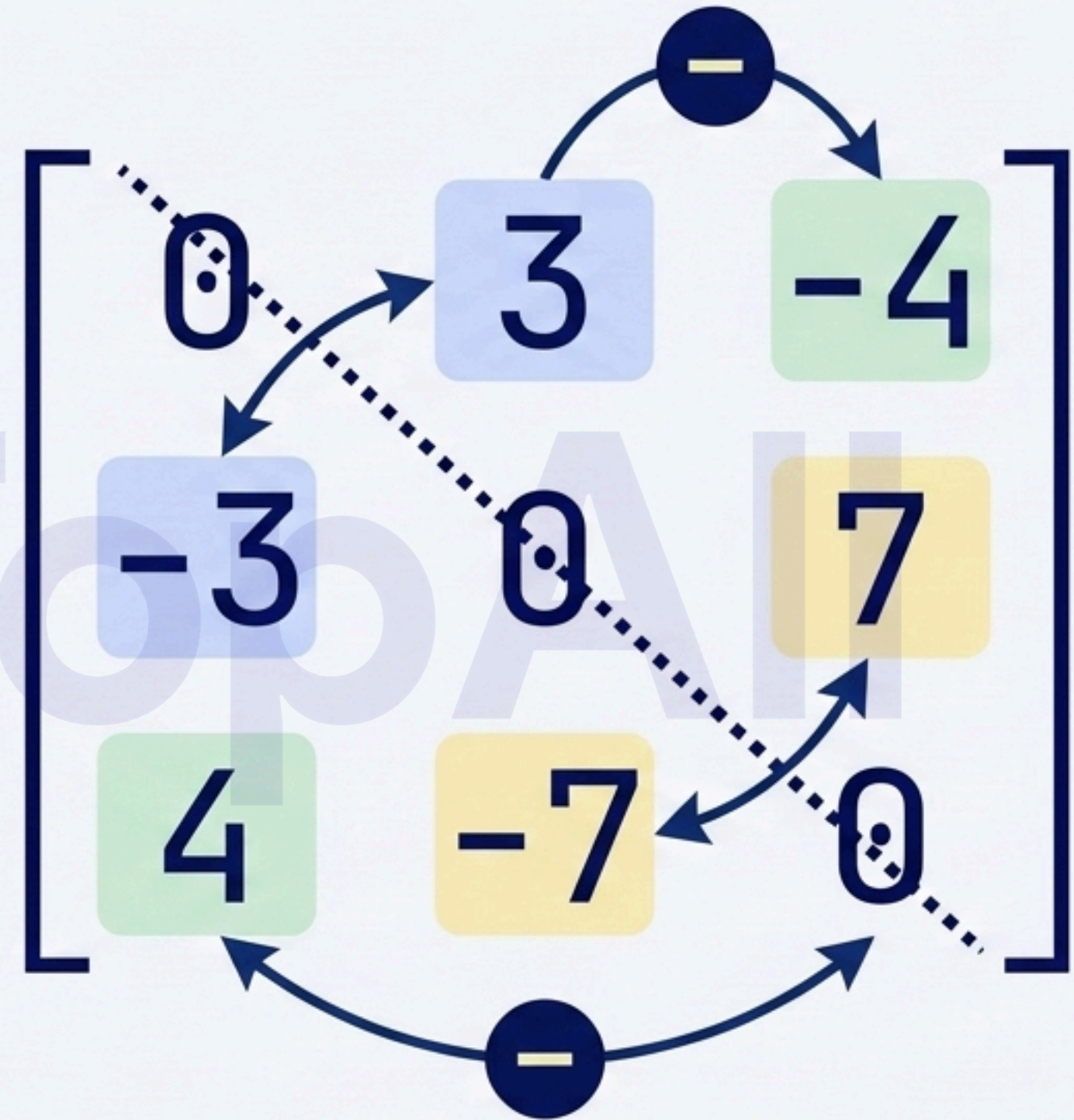


The Skew-Symmetric Matrix

$$A' = -A$$

$$a_{ji} = -a_{ij}$$

*Reflect across the diagonal,
then flip the sign.*



The Diagonal Inevitability

$$a_{ii} = -a_{ii} \quad (\text{By definition of Skew-Symmetric})$$

$$2a_{ii} = 0 \quad (\text{Bring to one side})$$

$$a_{ii} = 0 \quad (\text{Divide by 2})$$

Every diagonal element of a skew-symmetric matrix must be exactly zero.

A 3x3 skew-symmetric matrix is shown with its diagonal elements highlighted in green. The matrix is:

$$\begin{bmatrix} 0 & x & y \\ -x & 0 & z \\ -y & -z & 0 \end{bmatrix}$$



You've Learned the Theory. Let's Test Them Now.

$$E=mc^2$$



Turn theory into marks with **unlimited MCQs, smart analysis, and focused revision.**

Practice Now



At prep.topall.app

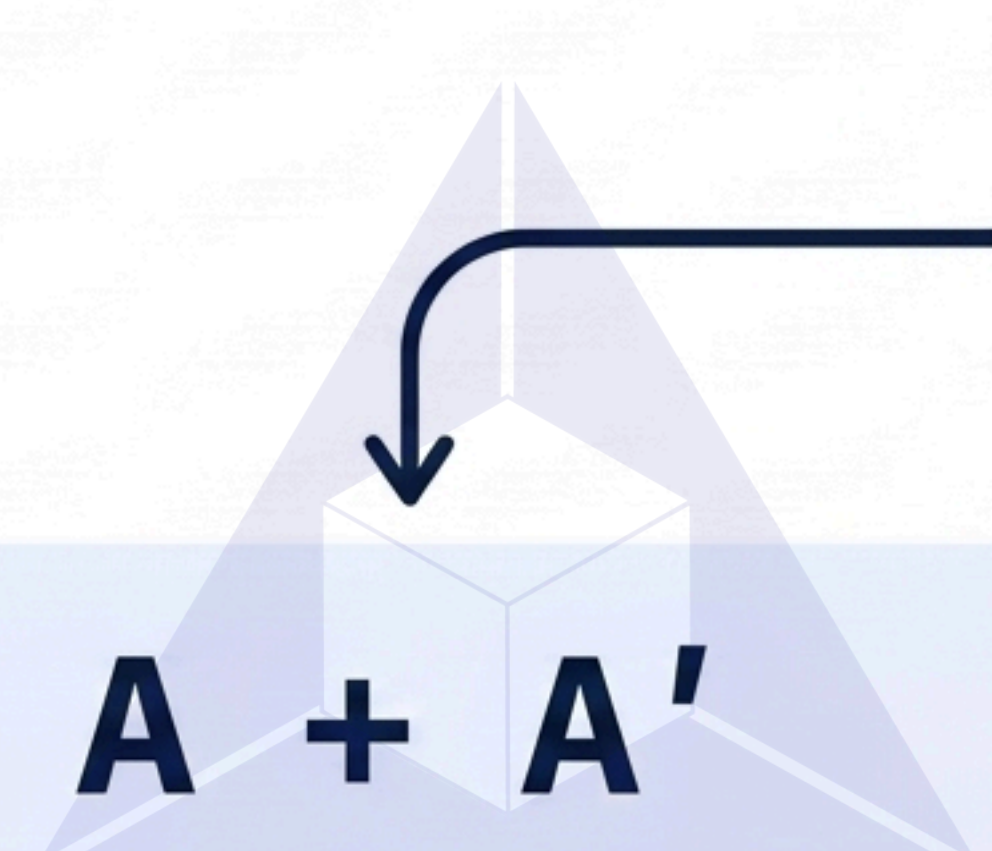
Key Highlights

- » Free Study Material, Videos & Infographics
- » Push Your Limits with Level-Based Challenges
- » Climb the Leaderboard Among Fellow Aspirants
- » Practice Unlimited MCQs for NEET & JEE
- » Get Clear Explanations, Not Just Marks
- » Track Your Performance Smarter

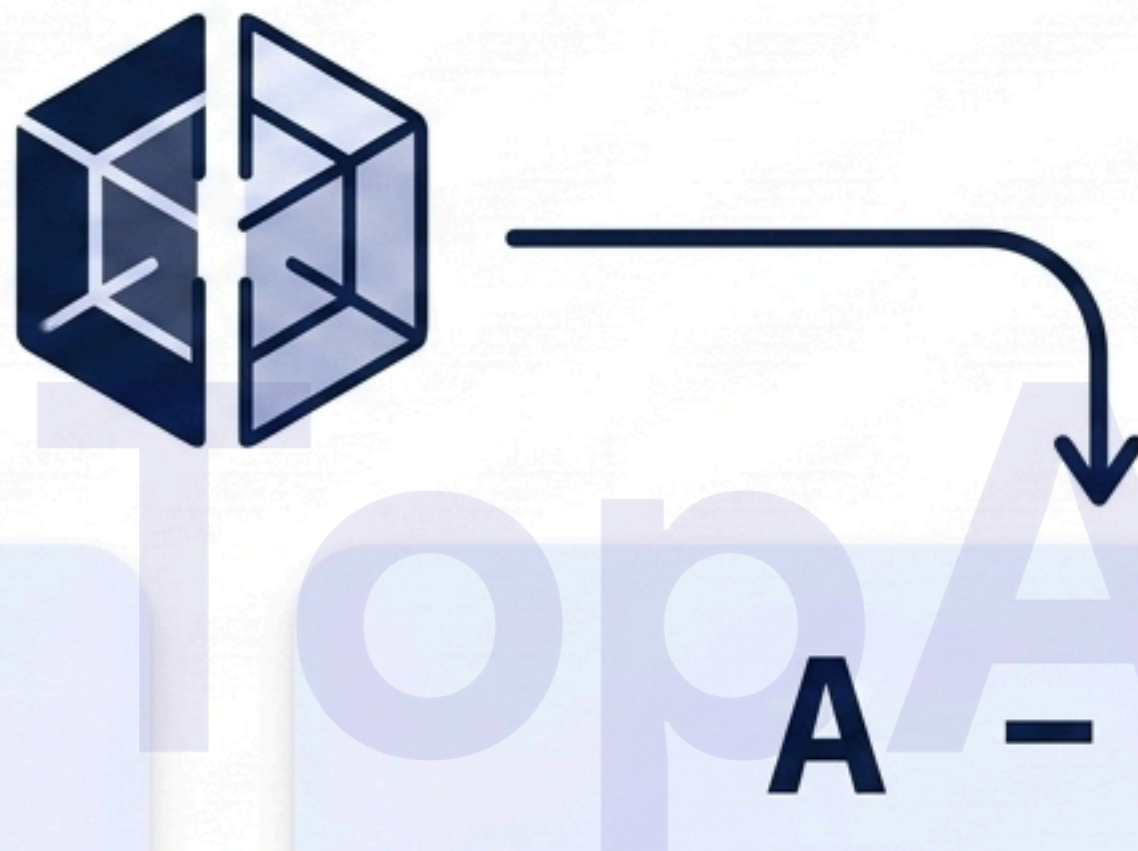


Theorem 1: Matrix Generation

For any square matrix A with real number entries:



$A + A'$
is always Symmetric.

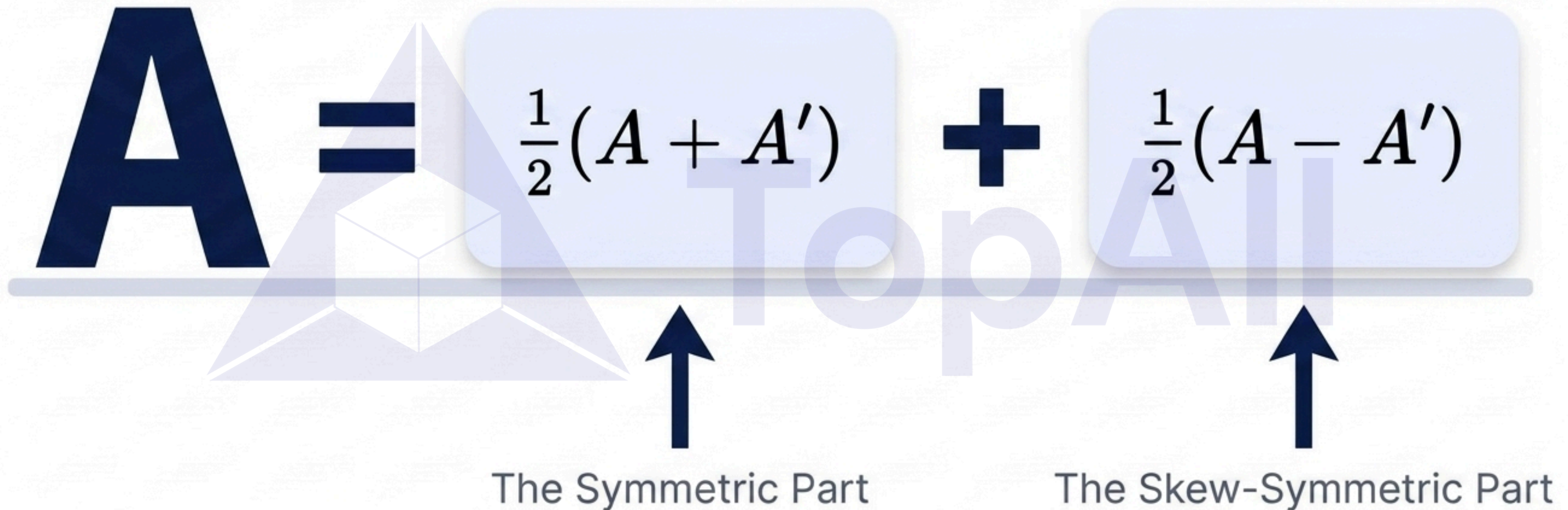


$A - A'$
is always Skew-Symmetric.



Theorem 2: Matrix Decomposition





The diagram illustrates the decomposition of a matrix A into its symmetric and skew-symmetric parts. On the left, a large dark blue letter A is shown. To its right is an equals sign. Following the equals sign are two light blue rounded rectangular boxes. The first box contains the expression $\frac{1}{2}(A + A')$, and the second box contains $\frac{1}{2}(A - A')$. A large dark blue plus sign is placed between these two boxes. Below the first box, a dark blue arrow points upwards to the expression. Below the second box, another dark blue arrow points upwards to the expression. At the bottom of the diagram, the text "The Symmetric Part" is centered under the first arrow, and "The Skew-Symmetric Part" is centered under the second arrow. A faint, large, light blue watermark "TopAll" is visible across the center of the diagram.

$$A = \frac{1}{2}(A + A') + \frac{1}{2}(A - A')$$

The Symmetric Part

The Skew-Symmetric Part

Any square matrix can be uniquely decomposed into this exact sum.



Common Exam Trap

$$M = \begin{bmatrix} 0 & 5 \\ 2 & 0 \end{bmatrix}$$

Zero diagonal alone does NOT prove skew-symmetry!

You must always verify that $M' = -M$. In this matrix, **the diagonal is zero, but $5 \neq -2$. Therefore, it is neither symmetric nor skew-symmetric.**

Chapter Cheat Sheet



Symmetric: $A' = A$

(Elements mirror perfectly).



Skew-Symmetric: $A' = -A$

(Elements mirror and invert sign).



Diagonal Rule

The main diagonal of a skew-symmetric matrix is always zero.



Decomposition

Any square matrix $A = \frac{1}{2}(A + A') + \frac{1}{2}(A - A')$.



You've Learned the Theory.

Now Let's Test It.

Reading notes gets you knowledge.

Practicing MCQs gets you marks.

That's exactly what TopAll Pro is built for.

Try TopAll Pro Now

What TopAll Pro Does Differently

-  **Stuck? Snap it. Solve it. — Doubts AI**
Photo → step-by-step solution in seconds, 24/7
-  **Your AI Coach finds your blind spots**
Concept-level weakness detection — not just chapter-level
-  **4.5 Lakh+ questions. Never run out.**
13× more content than any other prep app in India
-  **Build your own test in 60 seconds**
Pick a chapter, set difficulty — AI does the rest instantly.
-  **AI Recommendation that helps you improve**
AI Recommendation Analysis your Tests and tell you where you need to improve.



Practice the moment you finish studying
Jump in while the concept is still fresh in your head

4.5L+
MCQs

1.5L+
Students

AI Powered
In-Depth Analysis