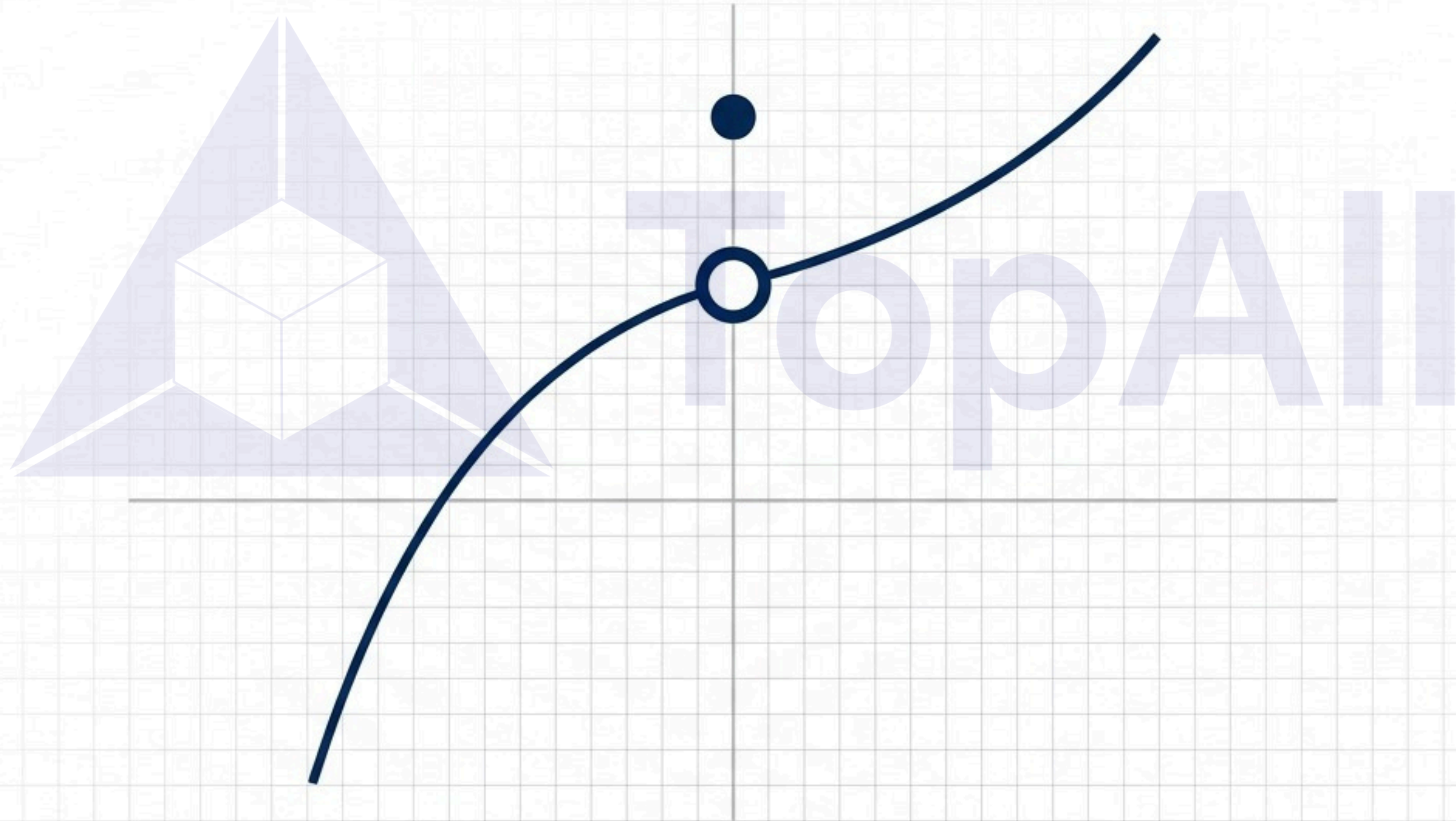


Limits: Nearby Behaviour Matters

Introduction to Calculus | JEE Mathematics Core Concepts

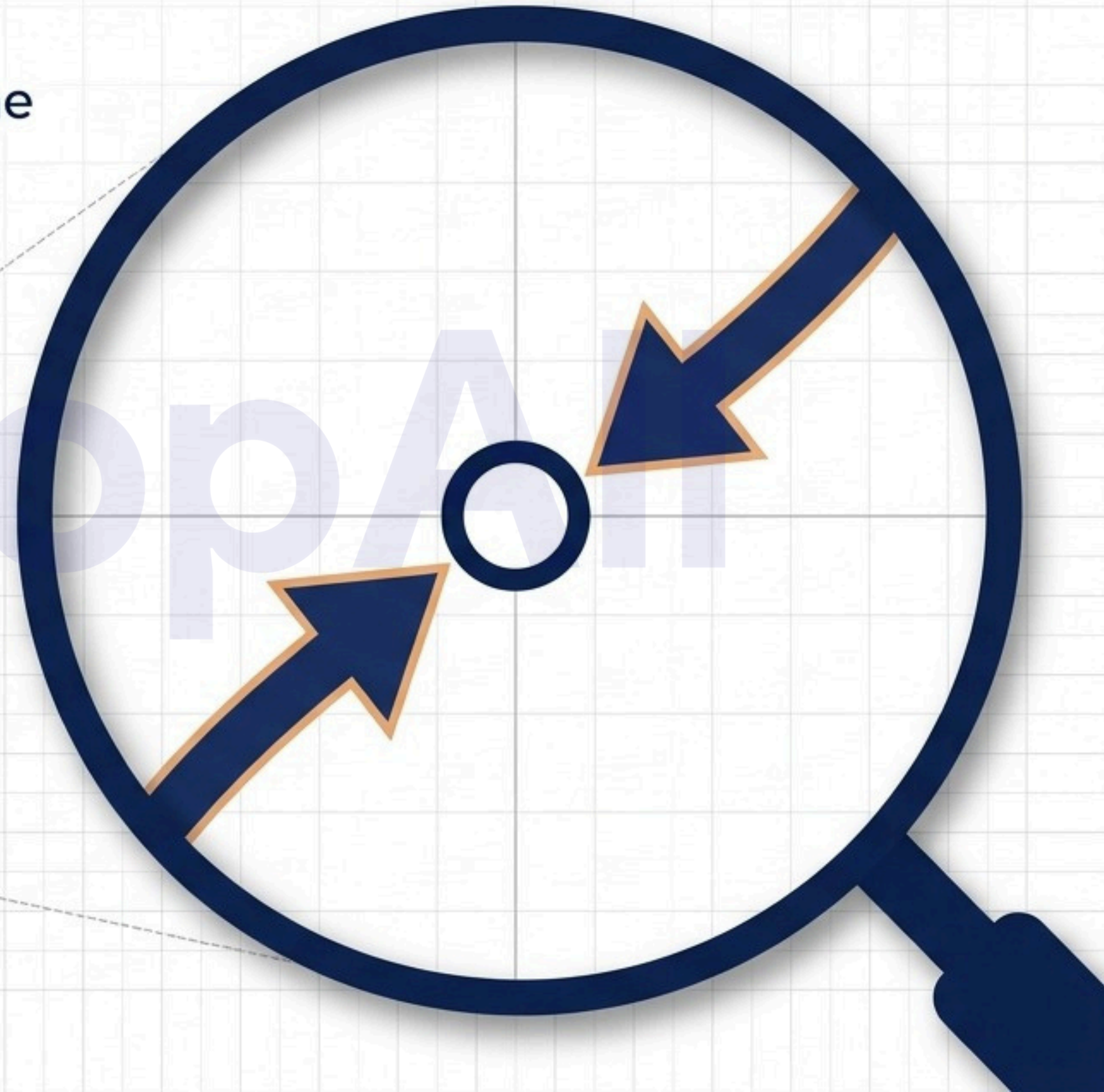
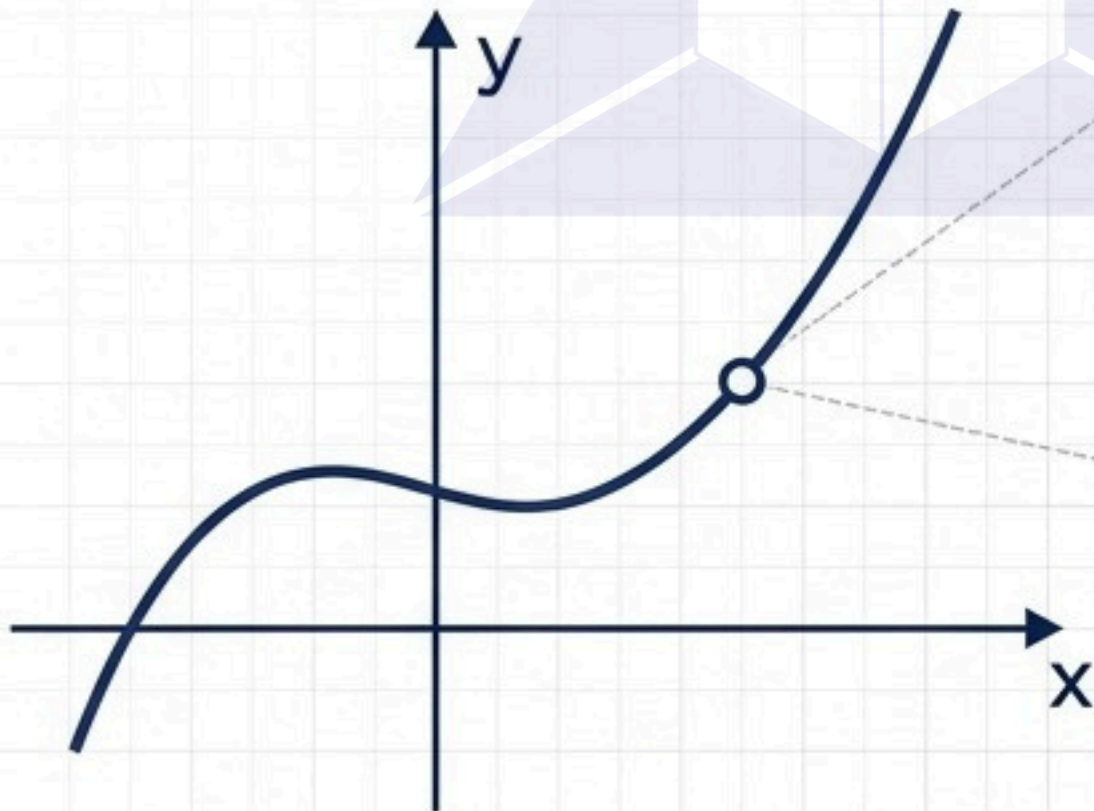


What is a Limit?

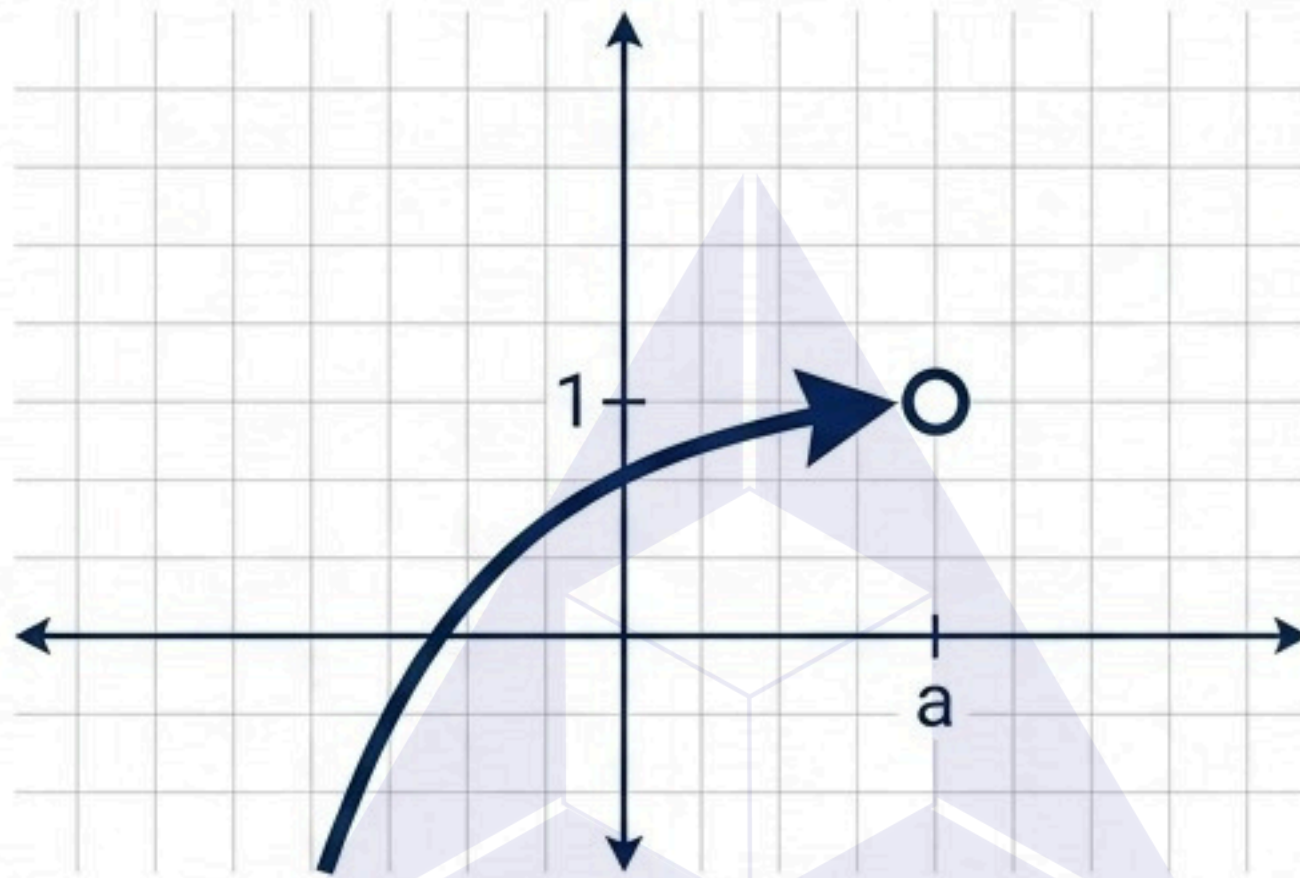
The limit is the expected value a function should assume at $x = a$, based entirely on the behavior of the points infinitely close to it.

Define $\lim_{x \rightarrow a} f(x) = L$

It is about the journey (the approach), not the destination (the actual point).



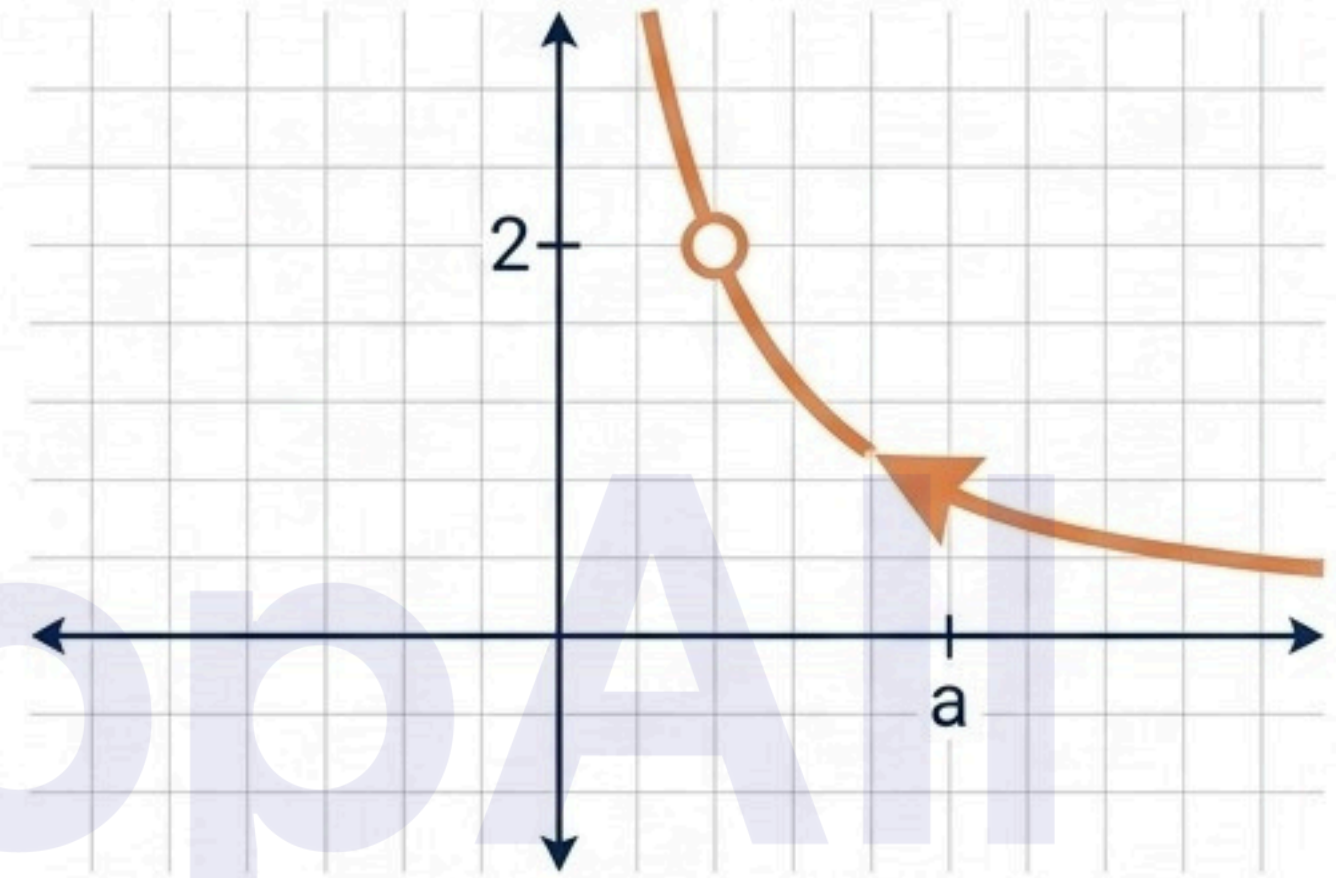
The Two Paths to “a”



Left Hand Limit (LHL):

$$\text{— } \lim_{x \rightarrow a^-} f(x) = 1$$

(Dictated by $x < a$)



Right Hand Limit (RHL):

$$\text{+ } \lim_{x \rightarrow a^+} f(x) = 2$$

(Dictated by $x > a$)



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The Golden Rule of Limits

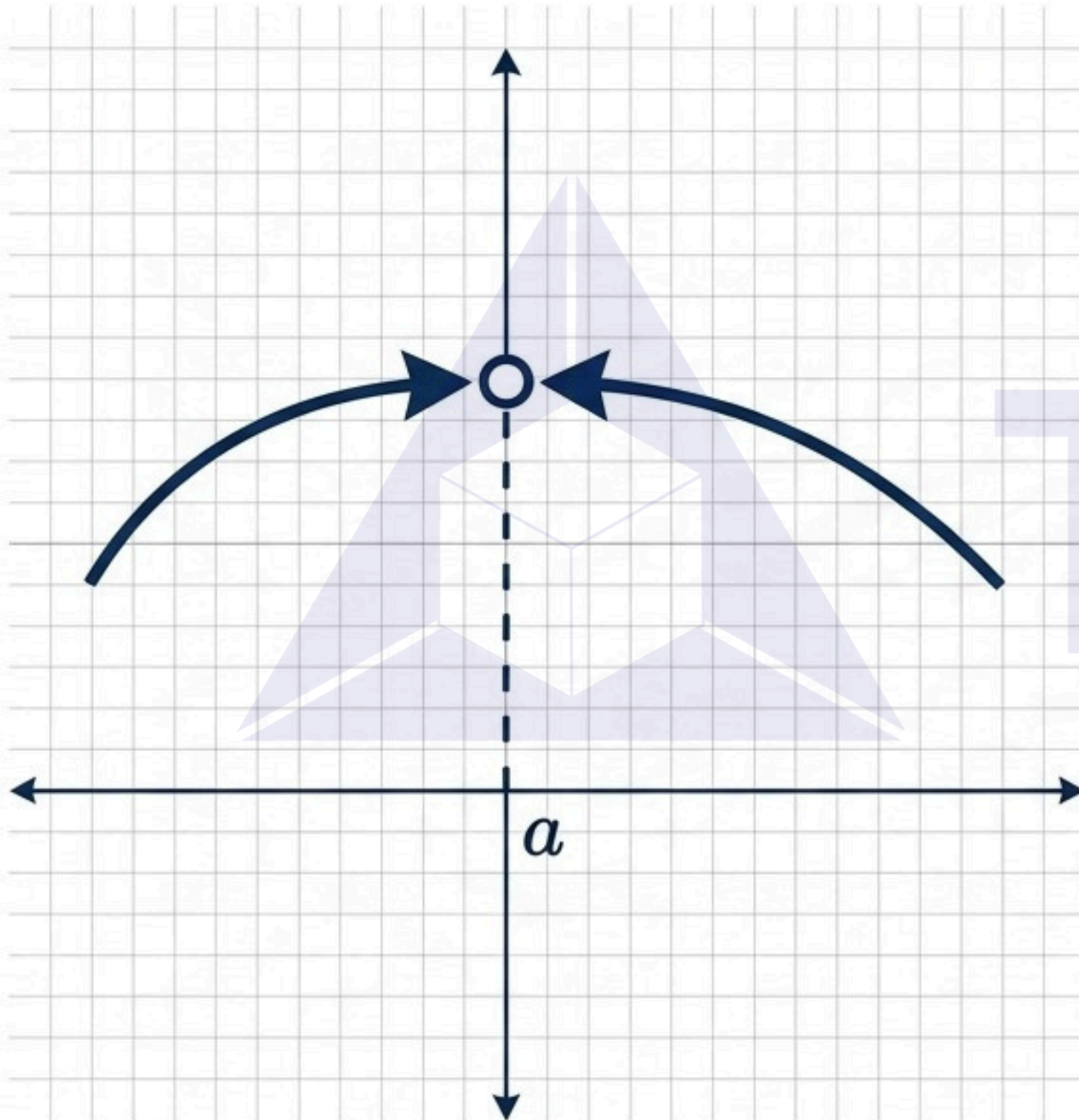


Limit Existence Theorem

$$\lim_{x \rightarrow a} f(x) \text{ exists} \Leftrightarrow \text{LHL} = \text{RHL}$$

$$\lim_{x \rightarrow a^-} f(x) = \lim_{x \rightarrow a^+} f(x) = L$$

The Classic Misconception

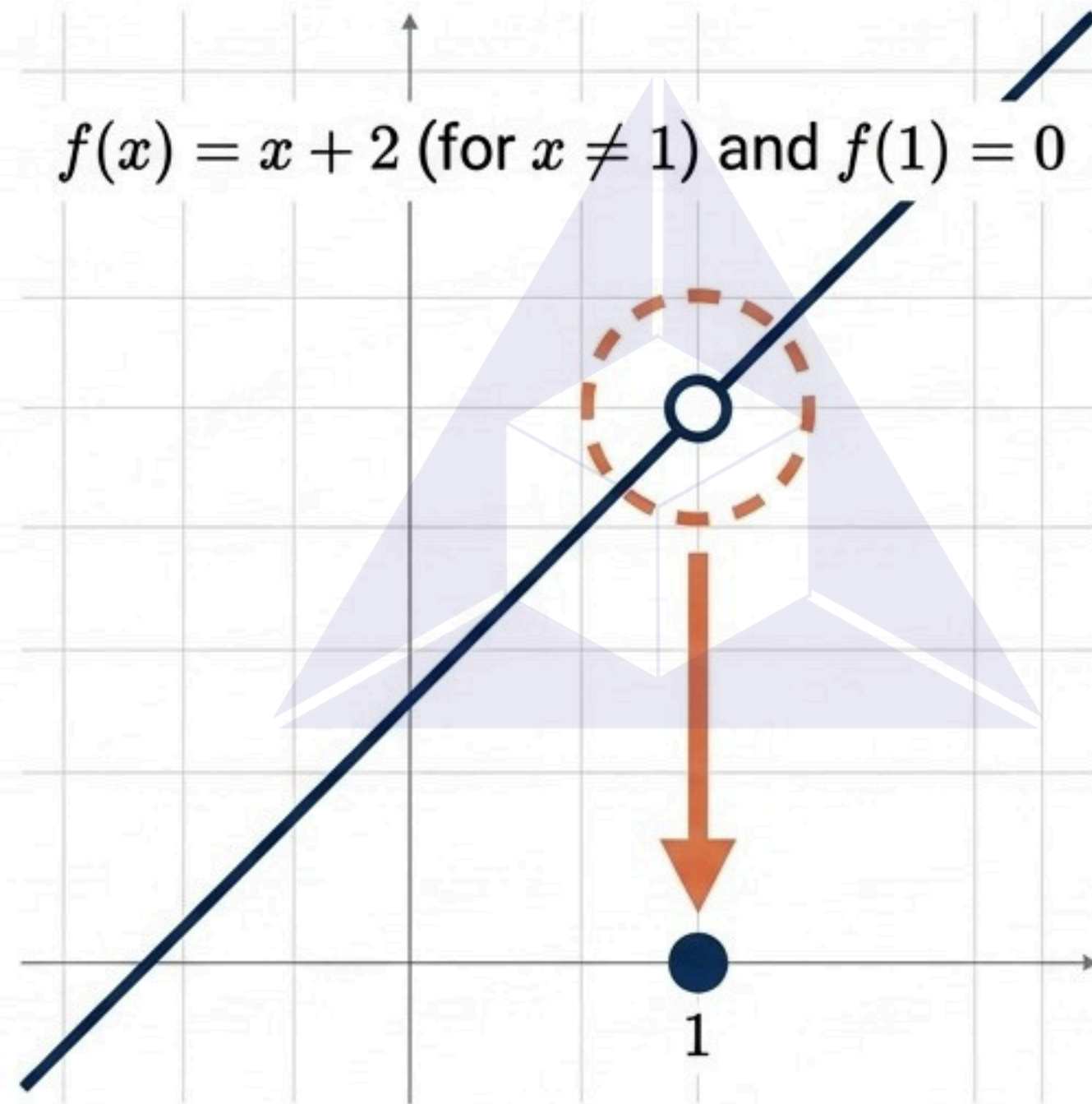


JEE TRAP ALERT

Assuming that $\lim_{x \rightarrow a} f(x)$ must equal $f(a)$.

- $f(a)$ might be completely different from the limit.
- $f(a)$ might not even be defined!
- The limit does not care what happens exactly at $x = a$.

Mini Application: Value $\neq$ Limit



$$\text{LHL: } \lim_{x \rightarrow 1^-} (x + 2) = 3$$

$$\text{RHL: } \lim_{x \rightarrow 1^+} (x + 2) = 3$$

$$\text{Conclusion: LHL} = \text{RHL} \rightarrow \lim_{x \rightarrow 1} f(x) = 3$$

Even though $f(1) = 0$, the limit firmly remains 3.

Module Wrap-Up



Key Takeaways

- ✓ Limits read the approach, not the isolated value. It is always about the neighborhood, never the specific destination point.
- ✓ Existence requires agreement. A limit only exists if both the Left Hand Path and Right Hand Path point to the exact same expected coordinate.
- ✓ Independence from $f(a)$. A function's actual defined value at $x = a$ has absolutely zero influence on the limit as $x \rightarrow a$.



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