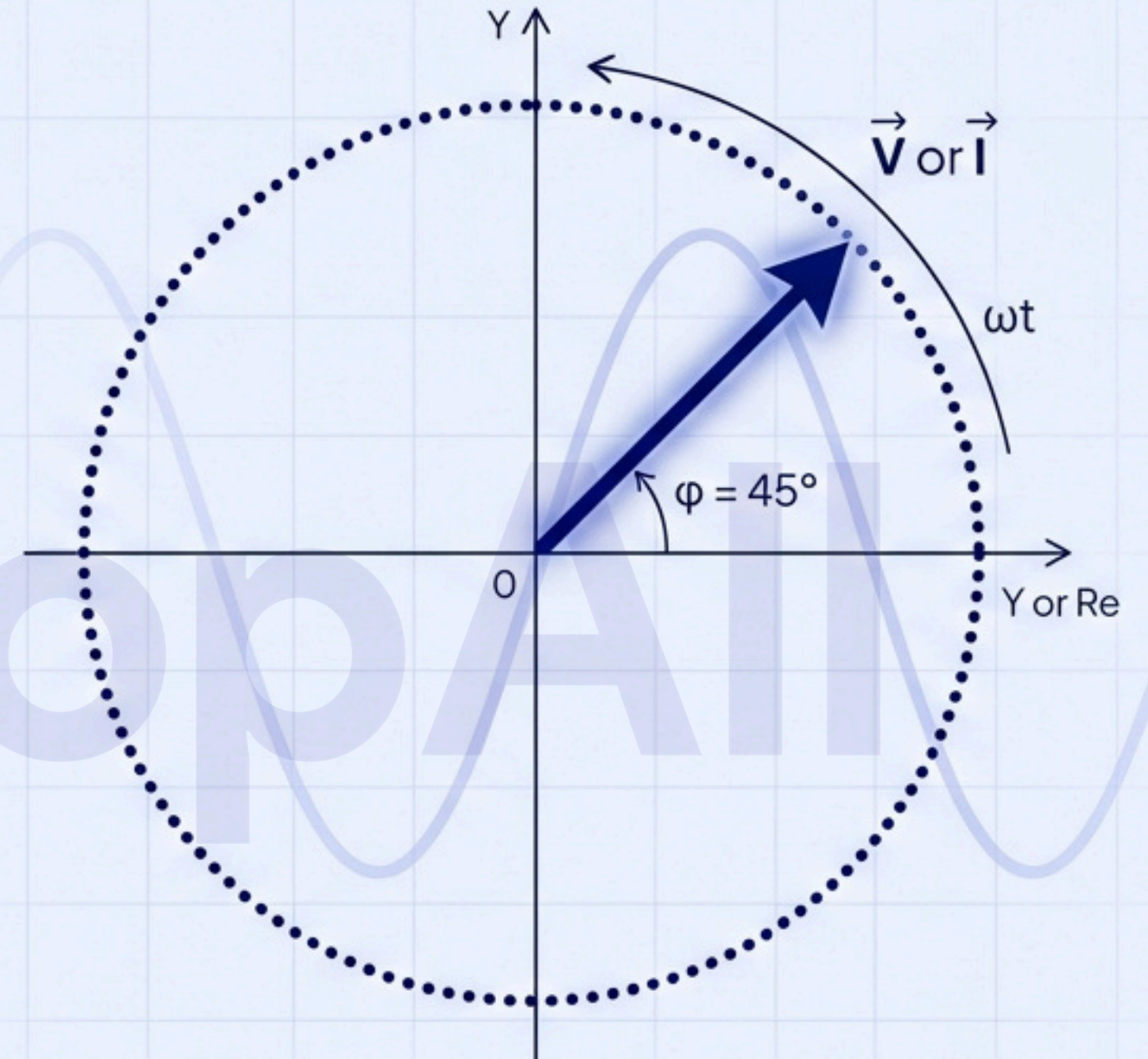


CLASS 12 PHYSICS • CHAPTER 7.3

Phasors Made Easy

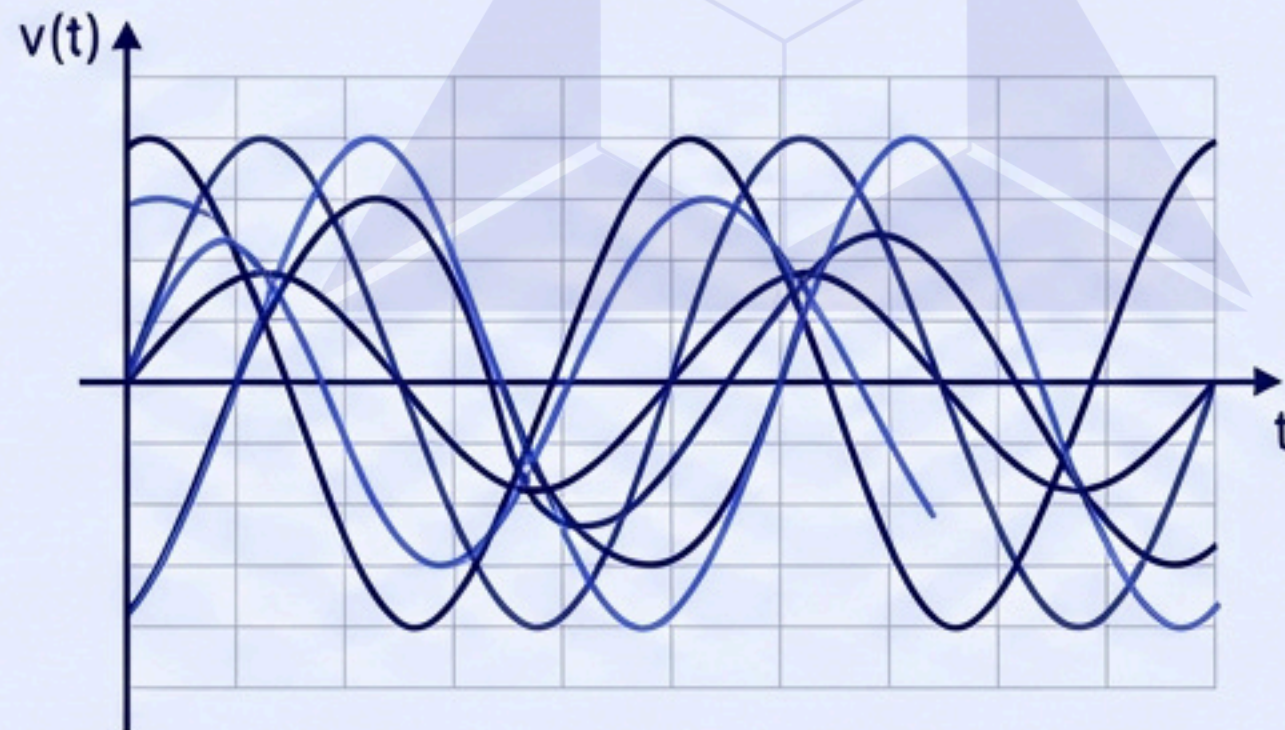
Representation of AC Current and Voltage by Rotating Vectors

Master the visual shortcut used to solve complex alternating current circuits without messy trigonometry.



Why Waveforms Are Hard To Compare

- AC voltage and current constantly change direction and magnitude over time.
- Tracking them using pure equations like $v = v_m \sin(\omega t)$ is mathematically exhausting.
- Comparing phase differences between multiple sine waves visually on a time-graph gets instantly cluttered.



Vs.

$$v_{\text{total}}(t) = v_1(t) + v_2(t) = V_{m1} \sin(\omega t + \phi_1) + V_{m2} \sin(\omega t + \phi_2)$$

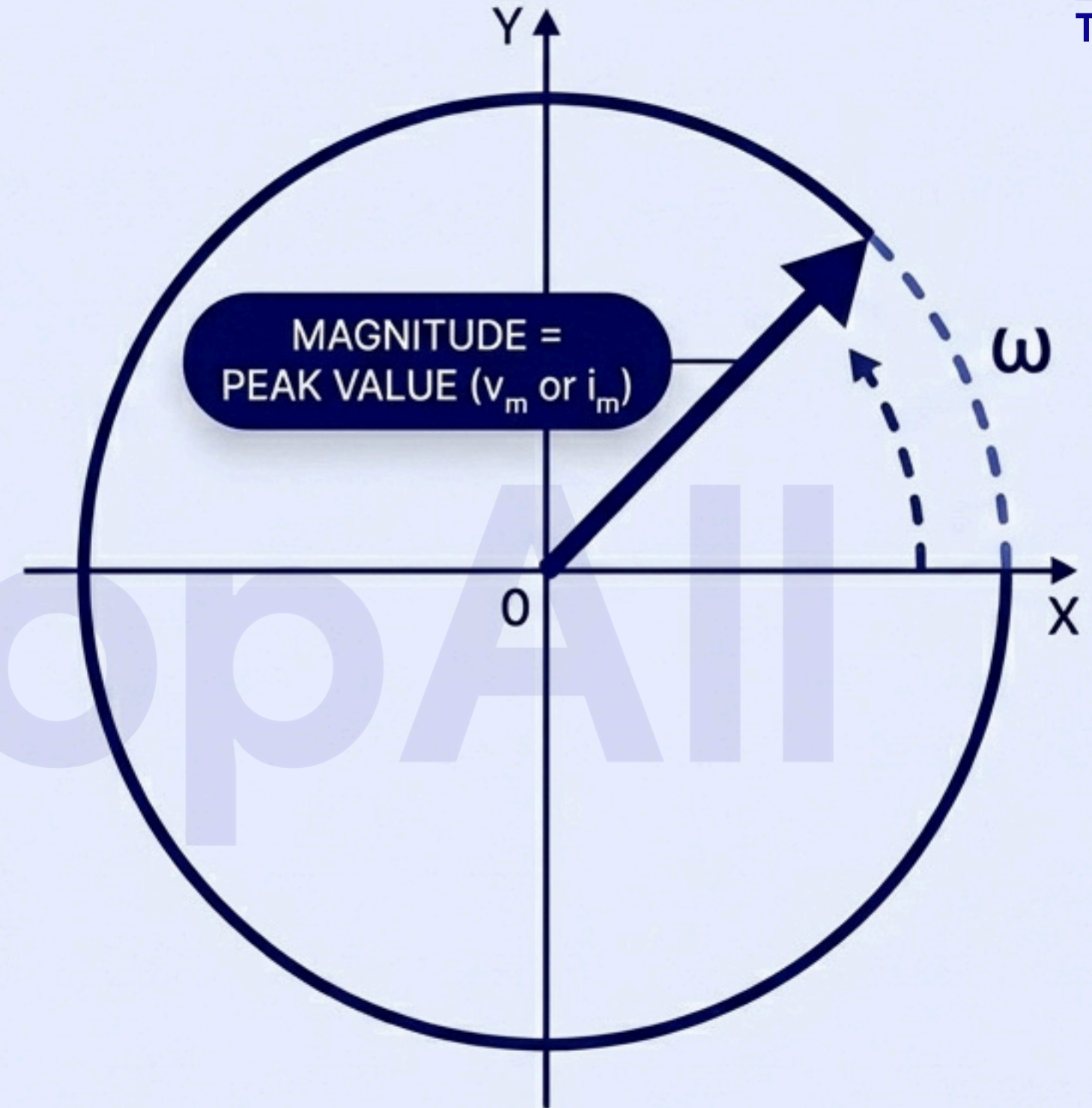
$$v_{\text{total}}(t) = V_{m1}(\sin(\omega t)\cos(\phi_1) + \cos(\omega t)\sin(\phi_1)) \\ + V_{m2}(\sin(\omega t)\cos(\phi_2) + \cos(\omega t)\sin(\phi_2))$$

$$v_{\text{total}}(t) = (V_{m1}\cos(\phi_1) + V_{m2}\cos(\phi_2))\sin(\omega t) \\ + (V_{m1}\sin(\phi_1) + V_{m2}\sin(\phi_2))\cos(\omega t)$$

$$V_{m_total} = \sqrt{(V_{m1}\cos(\phi_1) + V_{m2}\cos(\phi_2))^2 + (V_{m1}\sin(\phi_1) + V_{m2}\sin(\phi_2))^2}$$

Enter The Phasor

- A phasor is a vector that rotates about the origin with a constant angular speed ω .
- It transforms time-varying sine waves into a single rotating geometric line.
- Though V and I are scalar quantities, representing them as rotating vectors allows us to use simple vector addition.

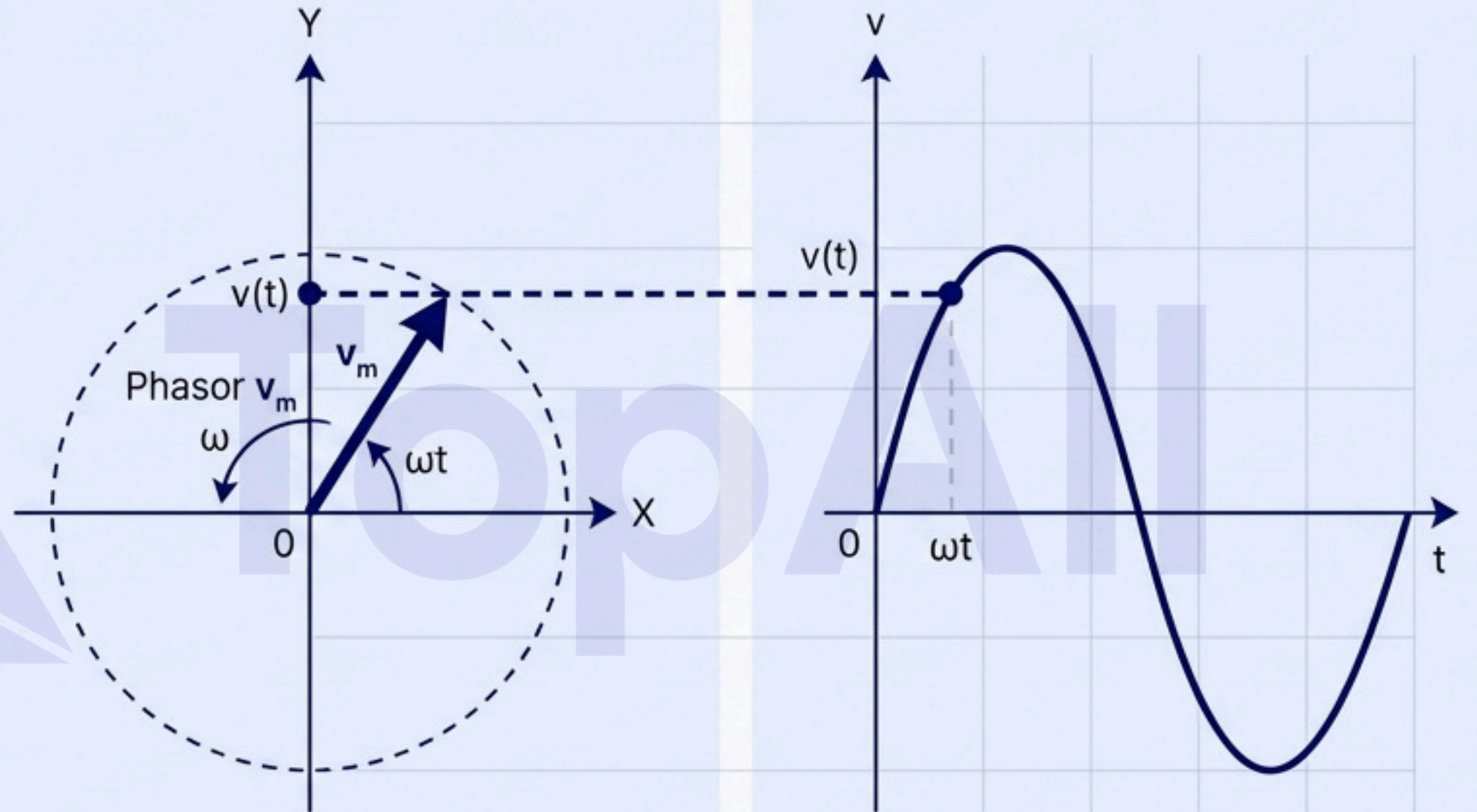


HOW IT WORKS

Vertical Projection Casts The Wave

- As the phasor rotates, its shadow on the vertical axis moves up and down.
- This vertical component perfectly matches the actual AC value at any given second.
- Rotate it a full 360° , and the projection traces out a perfect sine wave over time.

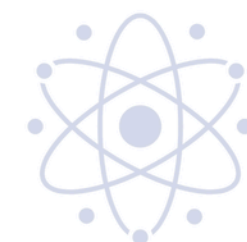
$$\text{INSTANTANEOUS VALUE} = v_m \sin(\omega t)$$





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

$$E=mc^2$$



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Key Highlights

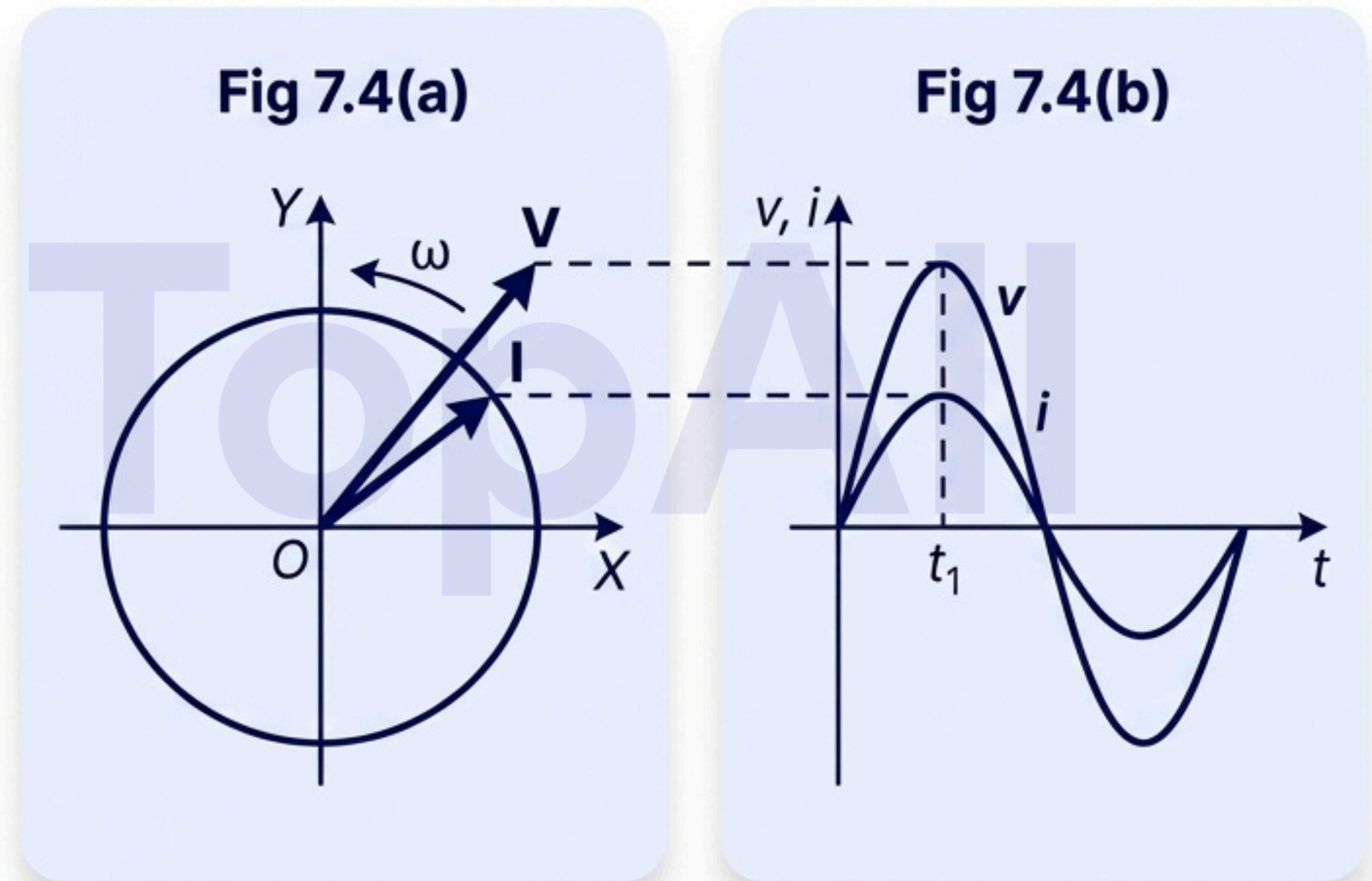
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FIGURE 7.4 BREAKDOWN

Connecting The Dots

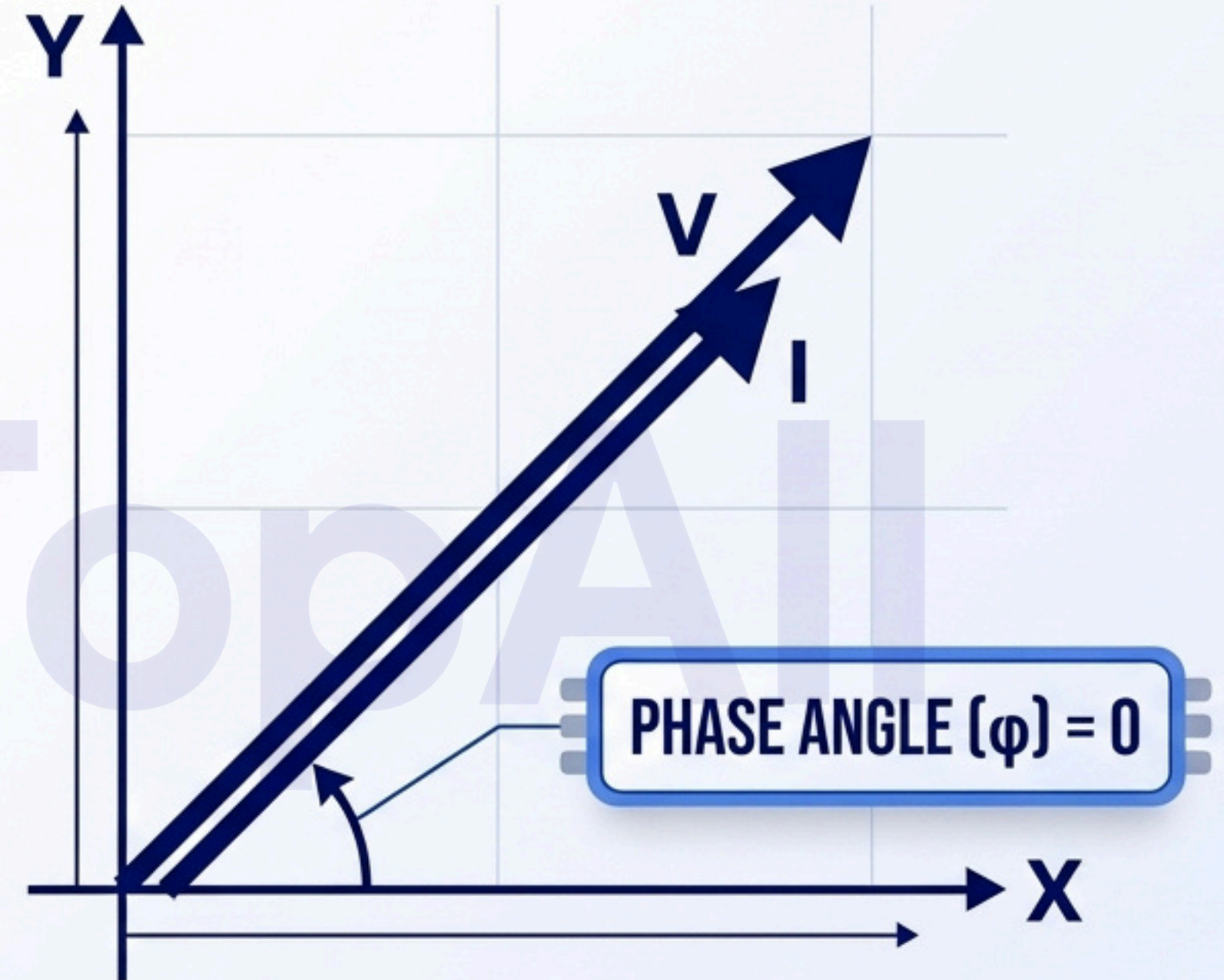
- Fig 7.4(a): Shows the Voltage (V) and Current (I) phasors frozen at a specific instant (t_1).
- Fig 7.4(b): Shows the continuous curves generated as those phasors rotate counter-clockwise.
- Notice how the taller V phasor maps perfectly to the taller voltage sine wave.



CIRCUIT APPLICATION

The Pure Resistor Case

- When AC voltage is applied to a pure resistor, the current and voltage rise and fall at the exact same time.
- Because they are in phase, their phasors point in the exact same direction at all times.
- They rotate together, locked in parallel.



Key Takeaways

- Length of the phasor = Peak Value (v_m or i_m).
- Speed of rotation = Angular Frequency (ω).
- Vertical Projection = Instantaneous Value at time t .

💡 **EXAM TIP:** Remember, voltage and current are SCALARS. Phasors are just a mathematical trick using vectors to make addition easier!

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