

Dimensional Formulae and Dimensional Equations

Learn the difference clearly and never confuse them again.

The Pattern

$$[M^a L^b T^c]$$

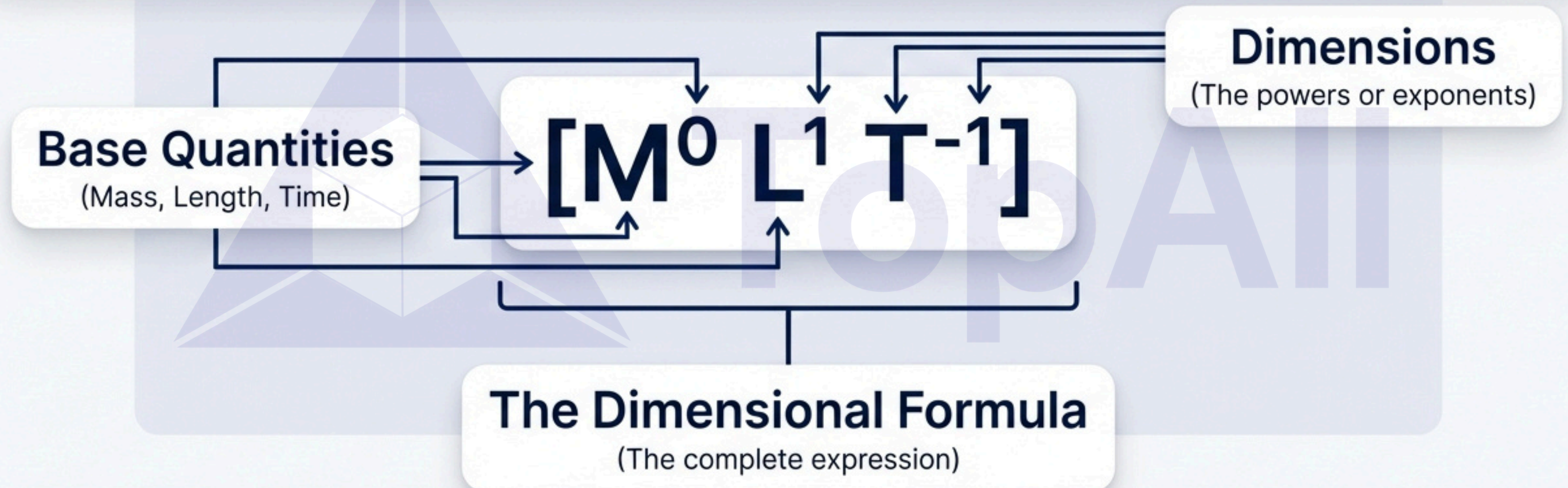


The Match

$$[X] = [M^a L^b T^c]$$

What is a Dimensional Formula?

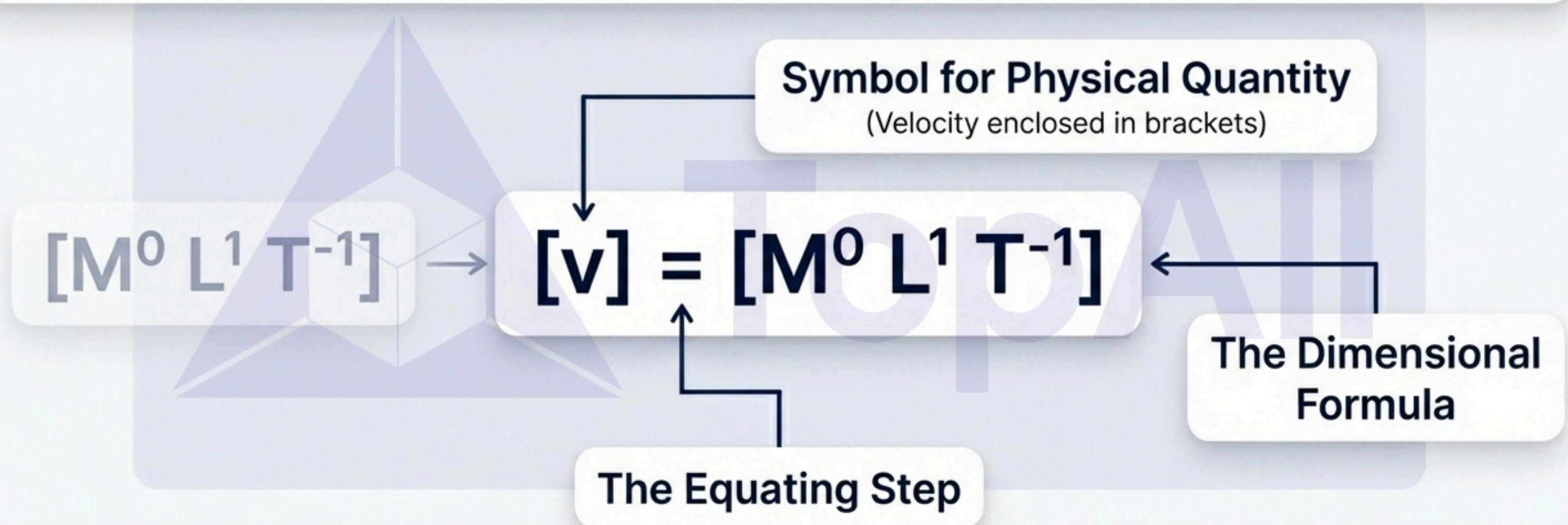
The expression which shows how and which of the base quantities represent the dimensions of a physical quantity.



A formula is just the raw expression. It does not contain an equals sign.

What is a Dimensional Equation?

An equation obtained by equating a physical quantity with its dimensional formula.



Notice the syntax: Physical Quantity in brackets = Dimensional Formula



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$$E=mc^2$$



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The Diagnostic Matrix: Spot the Difference

	Dimensional Formula (The Expression)	Dimensional Equation (The Statement)
Velocity	 $[M^0 L T^{-1}]$	$[v] = [M^0 L T^{-1}]$
Force	$[M L T^{-2}]$	$[F] = [M L T^{-2}]$

Essential Worked Examples

Volume

Formula:

$$[M^0 L^3 T^0]$$

Equation:

$$[V] = [M^0 L^3 T^0]$$

Velocity / Speed

Formula:

$$[M^0 L^1 T^{-1}]$$

Equation:

$$[v] = [M^0 L^1 T^{-1}]$$

Acceleration

Formula:

$$[M^0 L^1 T^{-2}]$$

Equation:

$$[a] = [M^0 L^1 T^{-2}]$$

Mass Density

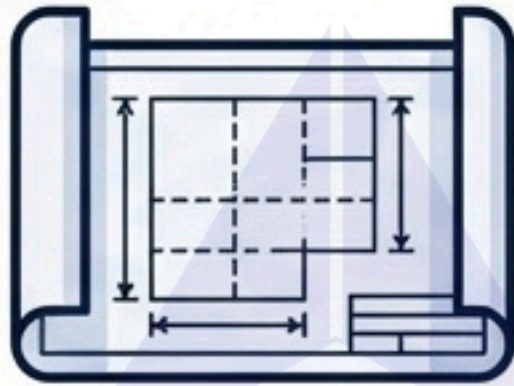
Formula:

$$[M^1 L^{-3} T^0]$$

Equation:

$$[\rho] = [M^1 L^{-3} T^0]$$

The Mental Model



Formula = The Pattern.

It tells you what base quantities are involved, but doesn't tell you who it belongs to.



Equation = The Match.

It assigns the specific physical quantity to its pattern using an equals sign.

Key Takeaway: If you see an equals sign connecting a physical quantity to its base dimensions, you are looking at an Equation. If you just see the brackets, it's a **Formula**.

Recap & Check Your Understanding

1. Dimensions represent the powers to which base quantities are raised.
2. A Dimensional Formula is just the bracketed expression (e.g., $[M L T^{-2}]$).
3. A Dimensional Equation equates a physical quantity to its formula (e.g., $[F] = [M L T^{-2}]$).

Which of the following is a Dimensional Formula?
Which of the following is a Dimensional Equation for mass density?

A) $[M L^{-3} T^0]$

B) $[\rho] = [M L^{-3} T^0]$



What does $[M^0 L^1 T^{-2}]$ represent by itself?
MCQ

A) The dimensional formula for acceleration



B) The dimensional equation for acceleration



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