

Dimensions of Physical Quantities

The hidden identity behind every physical quantity





A diagram showing a sphere with a grid of lines, representing a vector field or a sphere in motion, with a blue arrow pointing to the right.

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



A diagram showing a 3D cube with a grid of lines, representing volume or a 3D object.

$$[L^3]$$

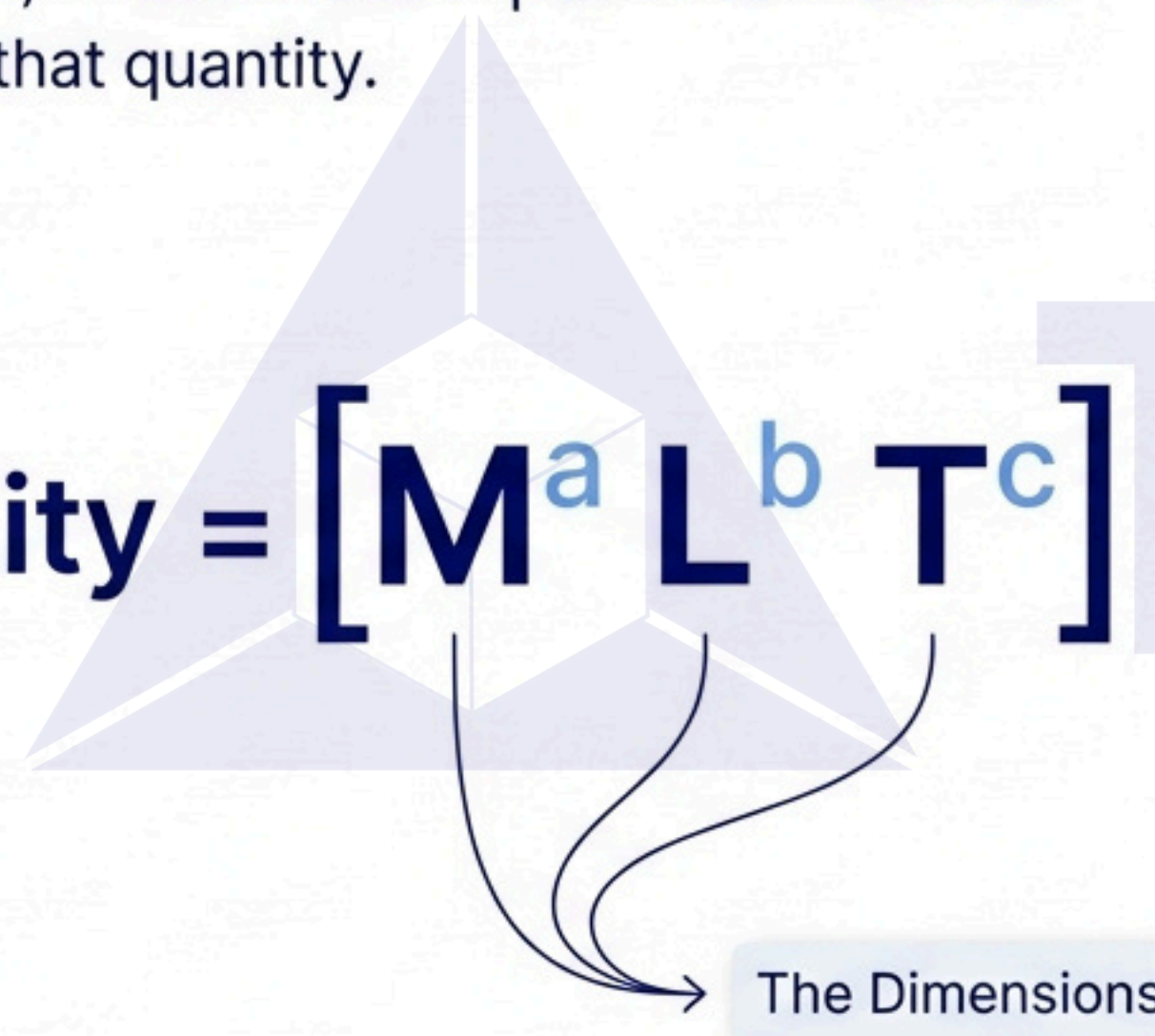


A diagram showing a hand pushing a rectangular block, with a blue arrow pointing to the right, representing a force vector.

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

Decoding the Physical World

Dimensions of a physical quantity are the powers (or exponents) to which base quantities are raised to represent that quantity.

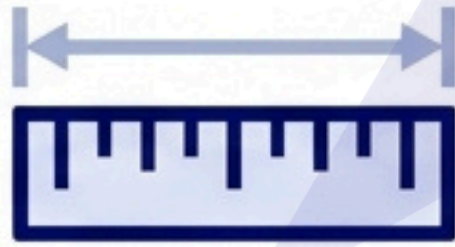
$$\text{Quantity} = [M^a L^b T^c]$$


The Dimensions

[X]

Using square brackets around a quantity means we are dealing strictly with the dimensions of that quantity, ignoring its magnitude.

The Core Source Code of Mechanics



Length

[L]



Mass

[M]



Time

[T]



Note: While mechanics relies entirely on [L], [M], and [T], the physical world is completed by four other SI base dimensions: Electric Current [A], Temperature [K], Luminous Intensity [cd], and Amount of Substance [mol].



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

$$E=mc^2$$



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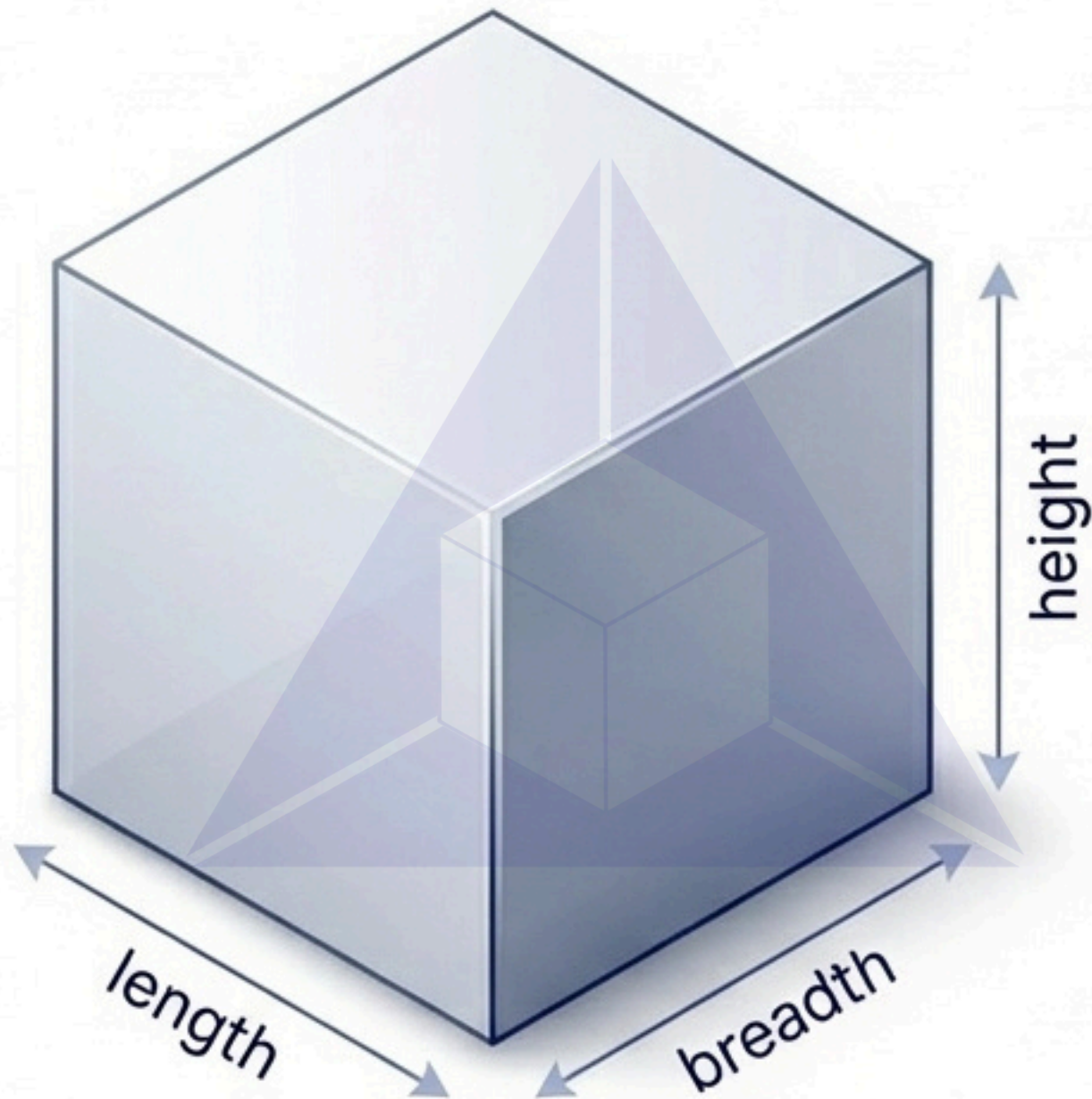
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Example: Deriving Volume

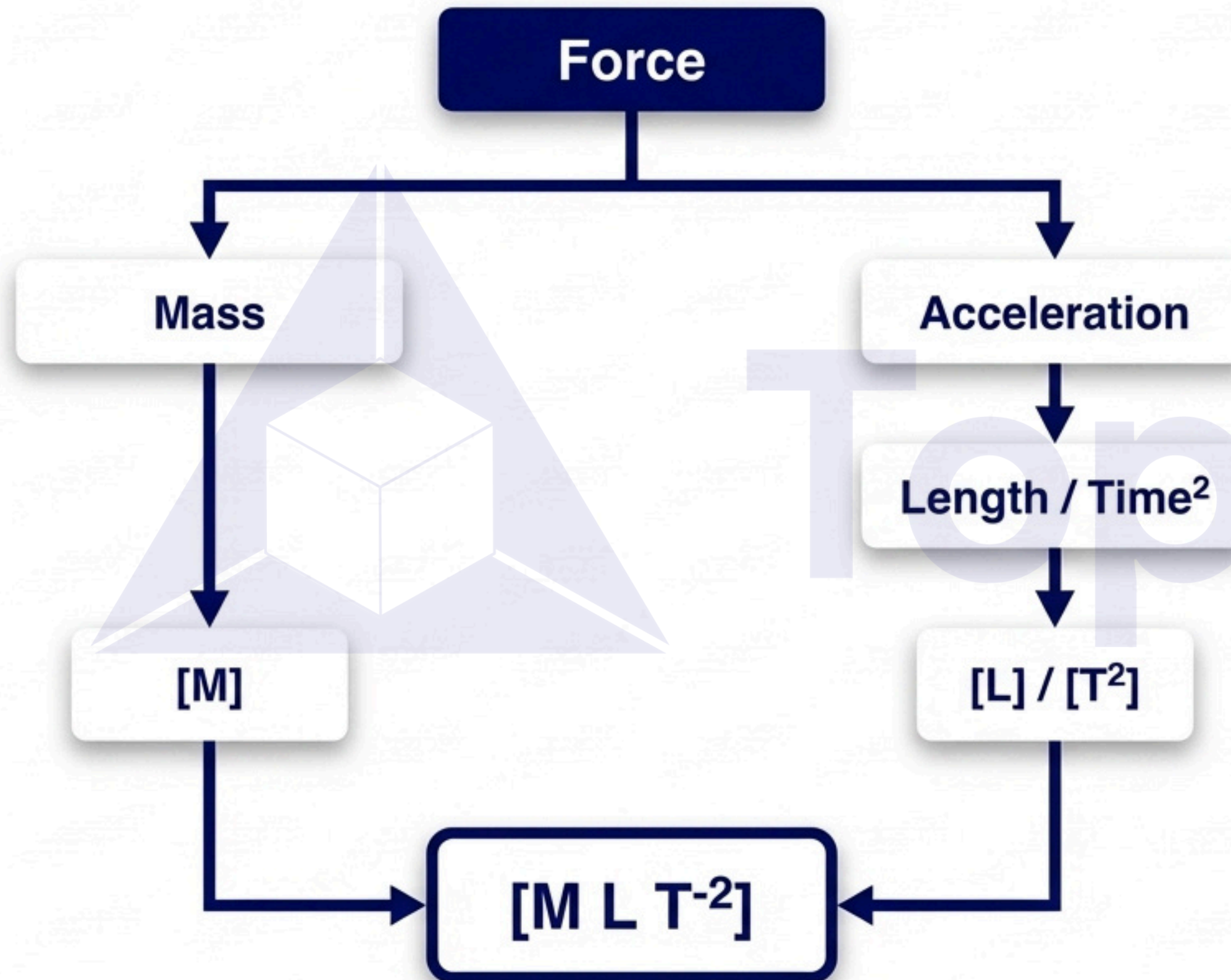


$$\text{Volume} = \text{length} \times \text{breadth} \times \text{height}$$

$$\text{Volume} = [L] \times [L] \times [L]$$

$$[L^3]$$

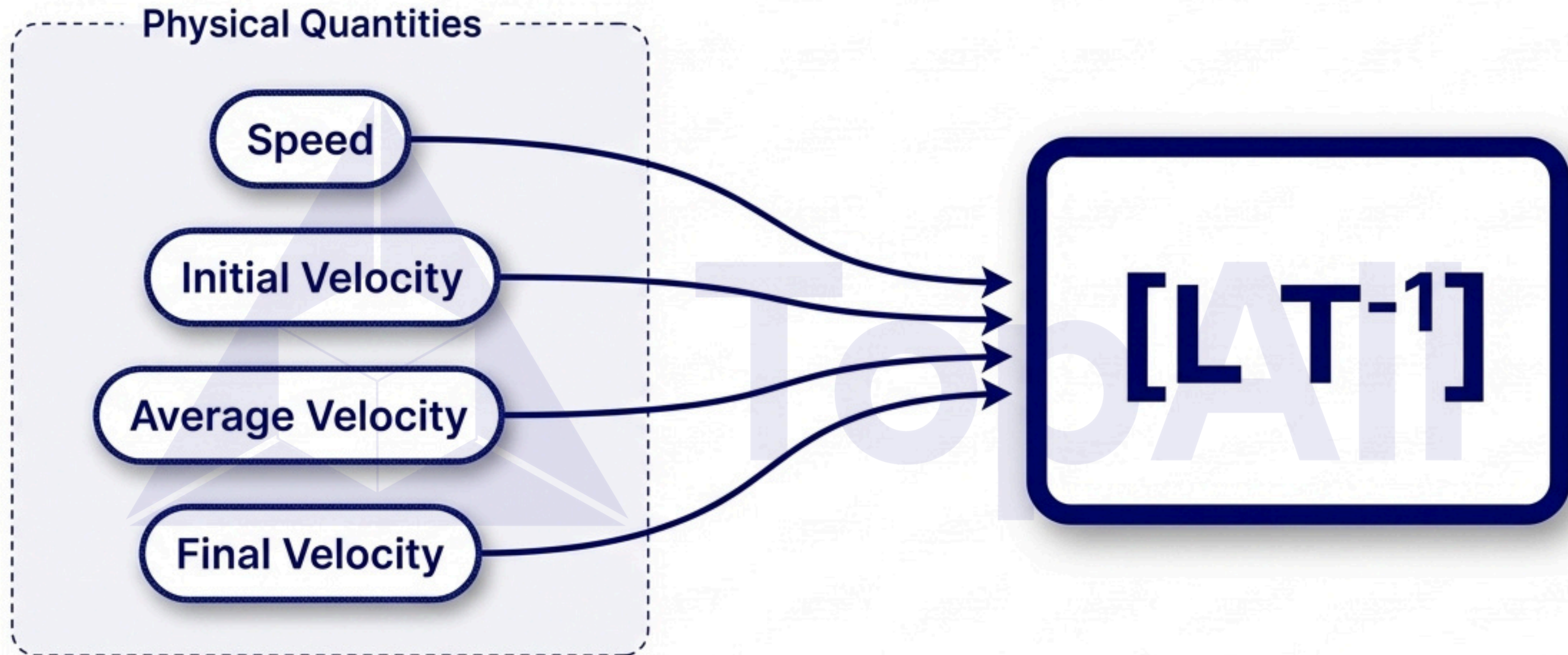
Decoding Complex Quantities: Force



The Code

- 1 dimension in mass
- 1 dimension in length
- -2 dimensions in time

Same Nature, Same Dimensions



Key Takeaway: Dimensions do not consider magnitudes or context. Because all these quantities fundamentally represent length divided by time, they share the exact same dimensional identity.

Recap & Practice

Summary

- ✓ Dimensions are the powers (exponents) of base quantities.
- ✓ Square brackets [] isolate the pure nature of a physical quantity.
- ✓ All quantities in mechanics can be decoded using [L], [M], and [T].

Test Yourself

Task Card 1

What are the dimensions of Area?

(Hint: length $\times$ breadth)

Task Card 2

What are the dimensions of Density?

(Hint: mass / volume)



You've Learned the Theory.

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