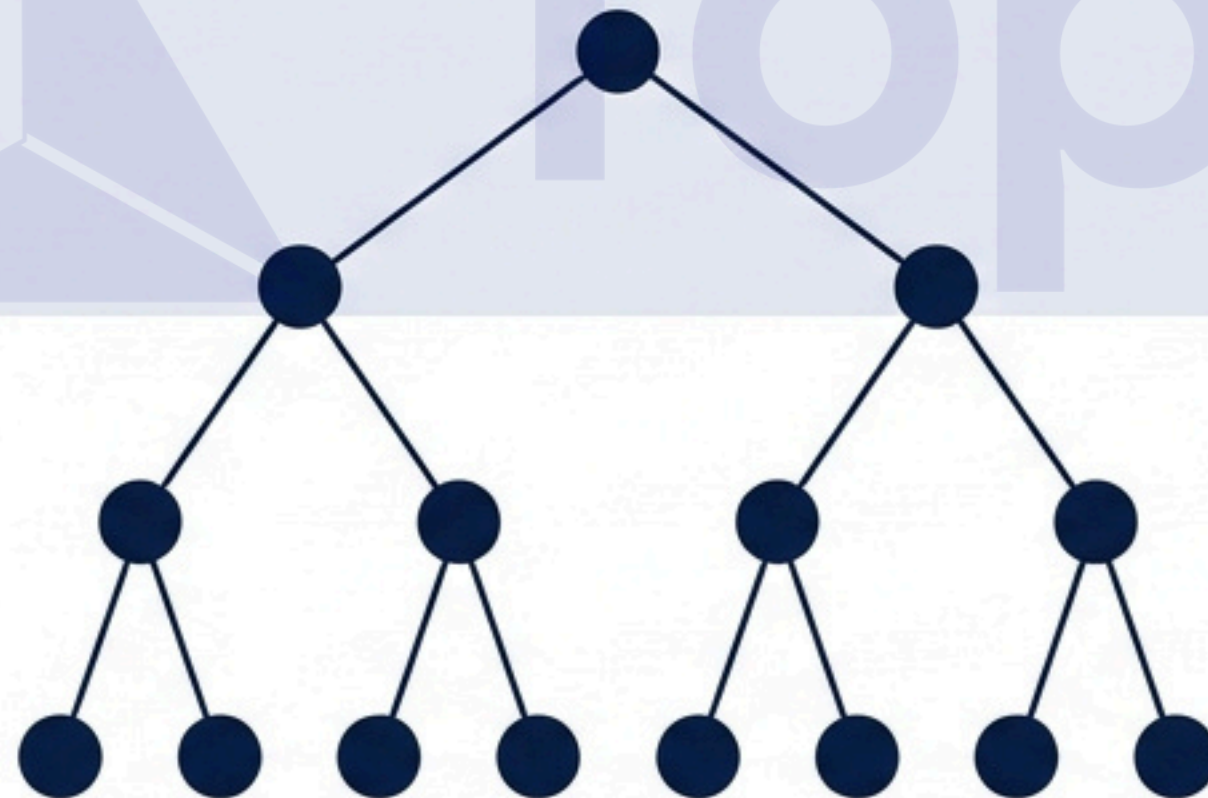


Exponential Growth

The mathematics of unimpeded biological potential.

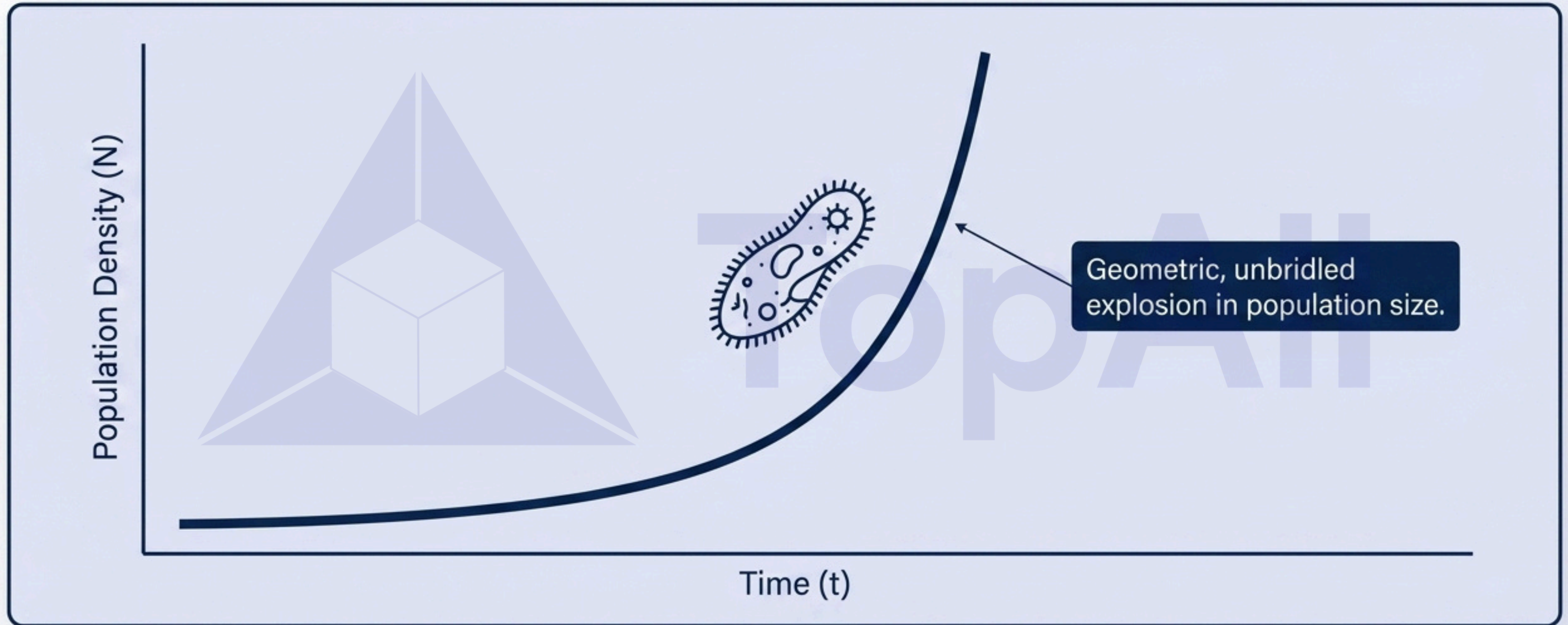


The Core Condition



When resources are unlimited, a species fully realizes its innate potential to grow in number. Charles Darwin observed that under these unhindered conditions, even a slow-growing animal like an elephant could reach enormous numbers.

The Visual Consequence: The J-Curve



Think of a tiny Paramecium starting with just one individual. Through binary fission, doubling every day, it would reach a mind-boggling population size in just 64 days.



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$$E=mc^2$$



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Modeling the Rate of Change

Change in population size
over a unit time period.

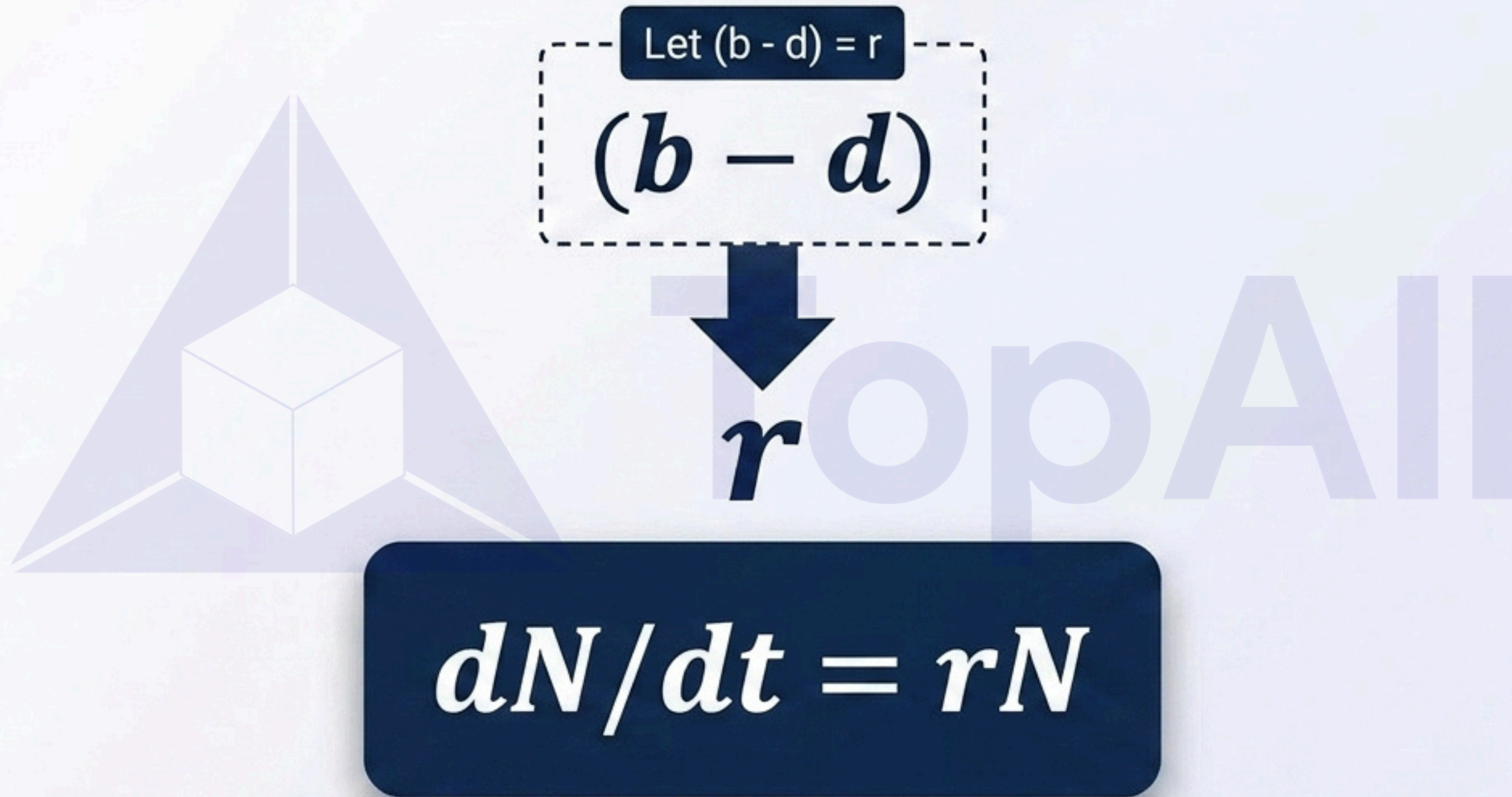
Per capita death rate.

$$\frac{dN}{dt} = (b - d) \times N$$

Per capita birth rate.

Current population size
(population density).

The Simplified Model



By substituting births minus deaths $(b - d)$ with r , we simplify the model to show the rate of change driven by a single vital parameter multiplied by the current population.

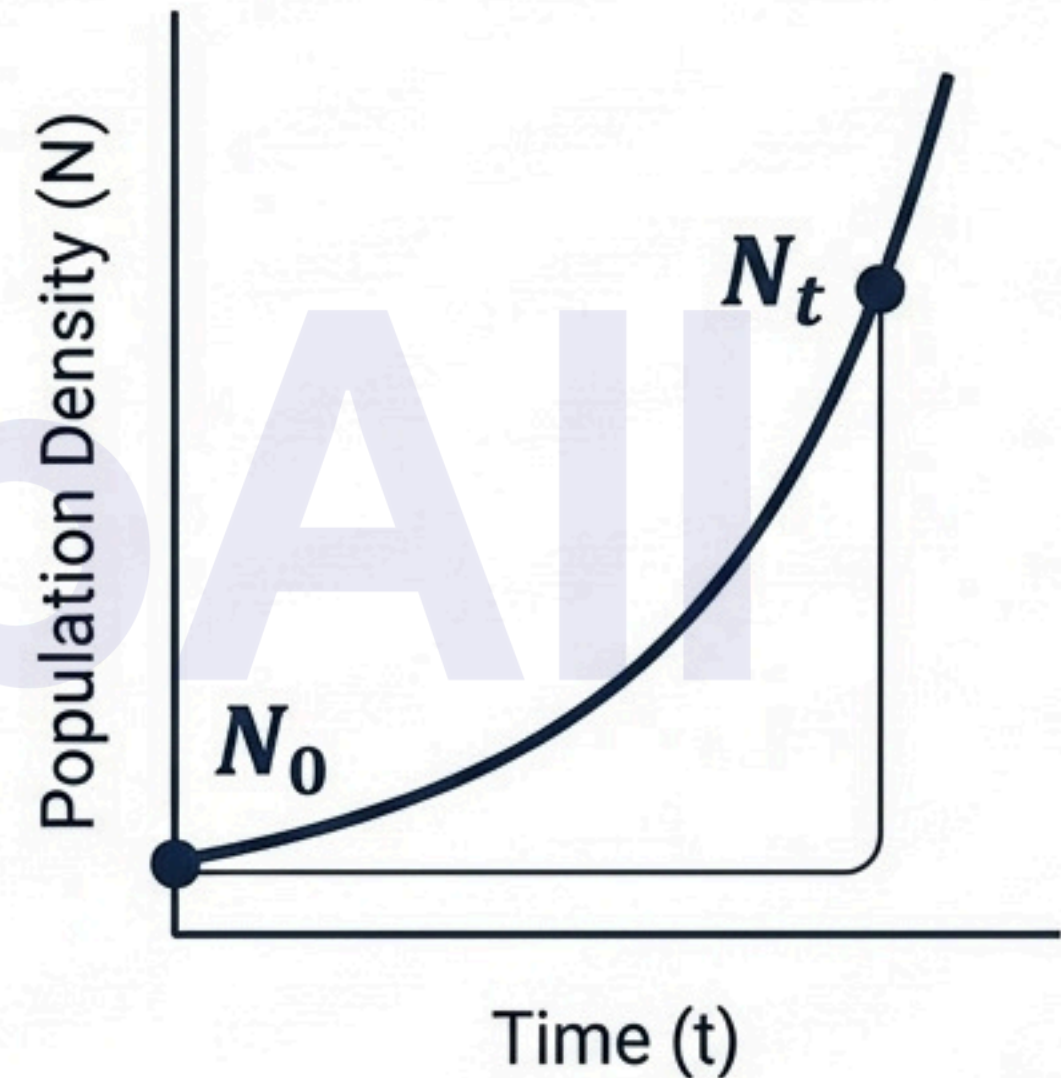
Predicting the Future (Integral Form)

$$N_t = N_0 e^{rt}$$

The base of natural
logarithms (2.71828)

N_t = Population density after time t

N_0 = Population density at time zero



Used to calculate exact population densities at any future time under unlimited resource conditions.

NEET Key Takeaway

r represents the intrinsic rate of natural increase.

It is the most critical parameter chosen for assessing the impact of any biotic or abiotic factor on population growth.

Real-world magnitudes of r :

- Norway rat = 0.015
- Flour beetle = 0.12
- Human population (India, 1981) = 0.0205



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