SEIR Epidemic Model — Mathematical Description
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1. Model Overview

The SEIR model is a compartmental model used to simulate the spread of infectiou
dividing the population into four groups:

    S(t): Susceptible individuals
    E(t): Exposed (infected but not yet infectious)
    I(t): Infectious individuals
    R(t): Recovered/removed individuals

Total population: N = S + E + I + R

2. Model Parameters

    β (beta): Transmission rate (per day)
    σ (sigma): Rate at which exposed individuals become infectious (1 / incubati
    γ (gamma): Recovery rate (1 / infectious period)

3. Differential Equations

The SEIR model is governed by the following system of ODEs:

    dS/dt = -β * S * I / N

    dE/dt = β * S * I / N - σ * E

    dI/dt = σ * E - γ * I

    dR/dt = γ * I

4. Interpretation

- Susceptible individuals (S) become exposed (E) after contact with an infectiou
- Exposed individuals (E) become infectious (I) after the incubation period.
- Infectious individuals (I) recover or are removed (R) at rate γ.

5. Example Parameters

- Population (N): 10,000
- Initial infected (I0): 10
- Initial exposed (E0): 20
- β (contact rate): 0.3
- σ (incubation rate): 1 / 5
- γ (recovery rate): 1 / 7

6. Simulation Output

The model shows the progression of the disease over time, visualizing the number
in each compartment (S, E, I, R) using numerical integration methods.