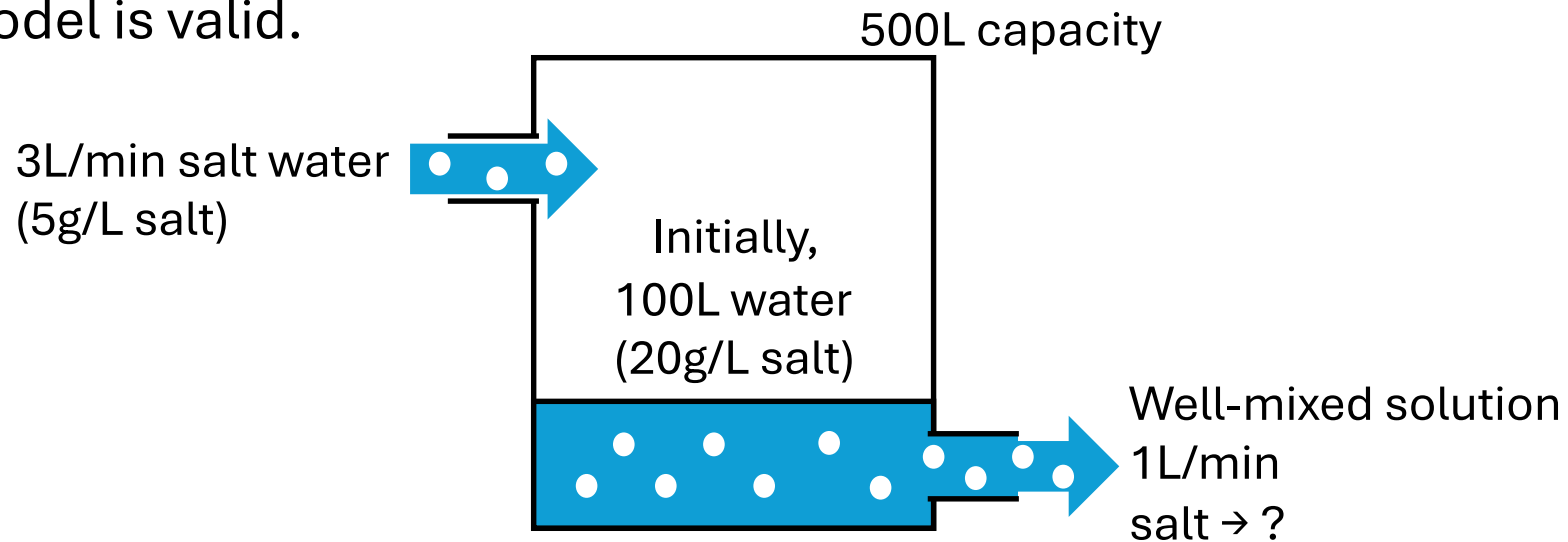


Tank

A tank initially contains 100 L of salt water with a salt concentration of 20 g/L. Brine with a concentration of 5g/L flows into the tank at 3 L/min, while the well-mixed solution flows out at 1 L/min. The tank has a capacity of 500 L. Let $S(t)$ be the amount of salt in the tank.

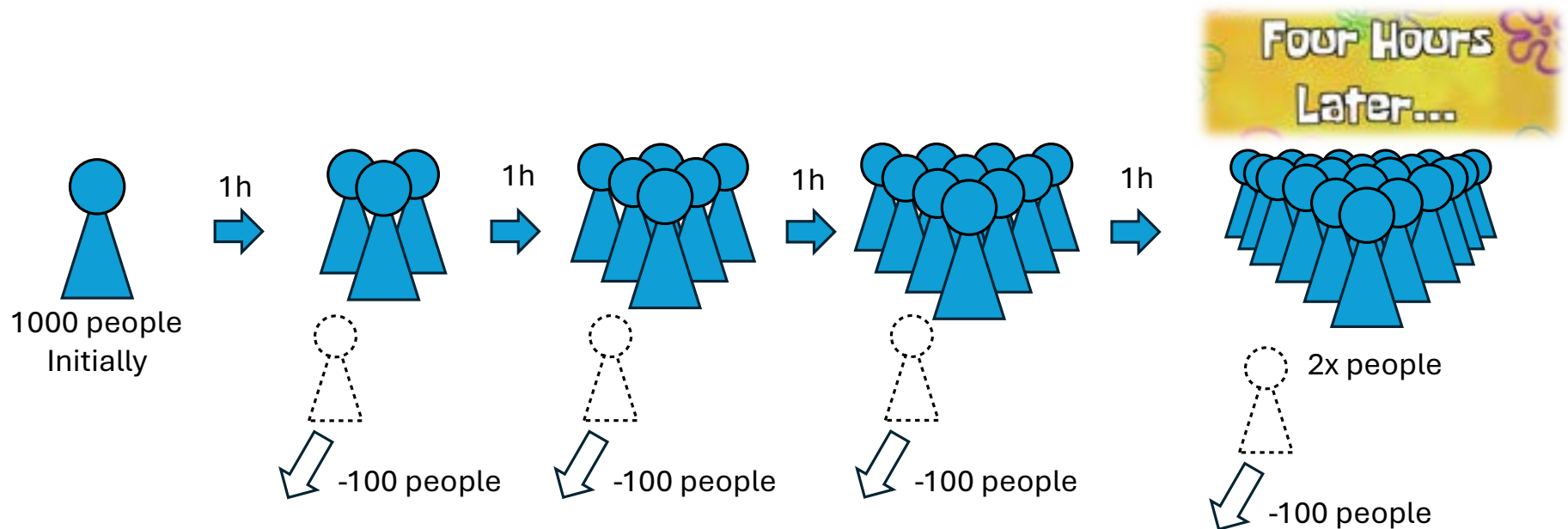
Set up an IVP for $S(t)$ and determine the time interval for which the model is valid.



Population

A population initially consists of 1000 individuals. Without intervention, the population doubles every 4 hours. A treatment removes individuals at a constant rate of 100 individuals per hour.

Let $P(t)$ be the population after t hours. Set up an IVP for $P(t)$

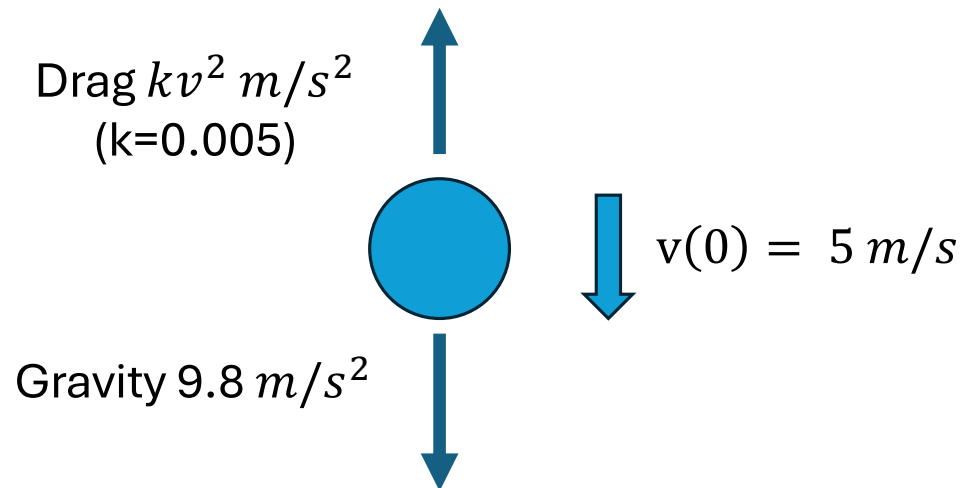


Motion

A falling object is released with an initial downward velocity of 5 m/s . Take downward as positive. Gravity produces a downward acceleration of $g = 9.8 \text{ m/s}^2$, while air resistance produces an acceleration of magnitude kv^2 opposite to the motion, where $k = 0.005 \text{ m}^{-1}$.

Let $v(t)$ be the downward velocity.

Set up the IVP and determine the terminal velocity.



Loan (optional)

A student has a loan balance of \$8,000. The loan accumulates interest continuously at 4% per year, while the student repays it continuously at \$1,800 per year. Let $B(t)$ be the remaining balance after t years. Set up an IVP and describe the time interval for which the model is valid.

