Population model:

\( P(t) = \) population as a function of time \( t \)

\( \frac{dP}{dt} = \) rate of growth

Important Assumption:

\( \frac{dP}{dt} \) is proportional to \( P(t) \)

Differential Equation:

\( \frac{dP}{dt} = k P(t) \)

Example from Mathematica:

\[
\text{DSolve}[[P'[t] == k P[t], P[t], t] \\
\quad \{[P[t] \to e^{kt} C[1]]\}
\]

\[
\text{DSolve}[[P'[t] == 5 P[t], P[0] == 10], P[t], t] \\
\quad \{[P[t] \to 10 e^{5t}]\}
\]

\[
\text{Plot}[10 e^{5t}, \{t, 0, 0.5\}]
\]