Mathematical modelling in biology

Methods to solve differential equations

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1 Solution of ODEs

1.1 First order differential equations

1.1.1 Right hand term does not depend on $\mathbf{y}(\mathbf{t})$

First order ODEs whose right hand term does not depend on $y(t)$:

$$\frac{dy}{dt} = k \qquad \wedge \qquad \frac{dy}{dt} = f(t)$$

Where k is a constant and $f(t)$ is a function of t, can be solved by integration:

$$\begin{aligned} \frac{dy(t)}{dt} &= k \\ \int \frac{dy(t)}{dt} dt &= \int k dt \\ y(t) &= kt + c \\ y(t) &= \int_{t_0}^{t_1} k ds = k(t_1 - t_0) \end{aligned}$$

$$\begin{aligned}
\frac{dy(t)}{dt} &= f(t) \\
\int \frac{dy(t)}{dt} dt &= \int f(t) dt \\
y(t) &= \int f(t) dt \\
y(t) &= \int_{t_0}^{t_1} f(s) ds
\end{aligned}$$