\[ \frac{dl}{dt} = k_p - k_d \]

\[ l = \, ? \]
\frac{dy}{dx} = m
\int dx = x + \text{constant}
\[
\frac{dy}{dx} = x^n
\]

\[
\Rightarrow \quad dy = x^n \, dx
\]

\[
y = \int dy = \int x^n \, dx = \frac{x^{n+1}}{n+1} + C
\]
\[ y = \frac{x^{n+1}}{n+1} + C \]
\[ \frac{dy}{dx} = \left[ \frac{1}{n+1} \right] \frac{d}{dx} x^{n+1} \]
\[ \frac{dy}{dx} = \left[ \frac{1}{n+1} \right] (n+1)x^n \]
\[ \frac{dy}{dx} = k x^n \]

\[ y = ? \]
\[
\frac{dy}{dx} = k x^n \quad \text{\(k\): a const}
\]

\[
\int dy = \int k x^n \, dx
\]

\[
y = k \int x^n \, dx
\]

\[
y = k \frac{x^{n+1}}{n+1} + C
\]
\[
\frac{dy}{dx} = e^x \\
\int dy = \int e^x \, dx \\
\text{say } y = \int e^x \, dx \\
y = e^x + C
\]
\[ y = \int e^x \, dx \]

\[ = \int \left[ 1 + x + \frac{x^2}{2} + \frac{x^3}{6} + \ldots \right] dx \]

\[ = \int dx + \int x \, dx + \int \frac{x^2}{2} \, dx + \int \frac{x^3}{6} \, dx \]
\[ y = x + \frac{x^2}{2} + \frac{x^3}{6} + \frac{x^4}{24} + \ldots \]
\[ y = 1 + x + \frac{x^2}{2} + \frac{x^3}{6} + \ldots + k = e^{x+k} \]
\[ \int e^x \, dx = e^x + k \]
\[ y = \int \cos(x) \]

\[ = \left[ -\frac{x^2}{2} + \frac{x^4}{4 \cdot 3 \cdot 2 \cdot 1} - \frac{x^6}{6 \cdot 5 \cdot 4 \cdot 3 \cdot 2 \cdot 1} \right] \]

\[ = x - \frac{x^3}{6} + \frac{x^5}{5!} - \frac{x^7}{7!} + \ldots + c \]
\[
\frac{dy}{dx} = \cos(x)
\]

\[y = \sin(x) + C\]
\[
\frac{dy}{dx} = \sin x
\]

\[
y = -\cos x + \text{Const.}
\]
\[ f(x) = 2 \]
$$\int f(x) \, dx = \left( dx_1 \cdot f(x_1) \right) + \left( dx_2 \cdot f(x_2) \right) + \left( dx_3 \cdot f(x_3) \right) + \left( dx_4 \cdot f(x_4) \right)$$
\[ \int f(x)\,dx = \frac{2}{f'(x_1)}\,dx_1 + f(x_2)\,dx_2 + f(x_3)\,dx_3 + f(x_4)\,dx_4 \]
\[ \int_{a}^{b} \frac{dy}{dx} \, dx = y(x=b) - y(x=a) \]
Definite integral

\[
\int_a^b f'(x) \, dx = \int_a^b \frac{df}{dx} \, dx = \left[ f \right]_a^b = f(x=b) - f(x=a)
\]
\[
\frac{dy}{dx} = x
\]
\[
\int_0^2 dy = \int_0^2 x \, dx
\]
\[
= \left. \frac{x^2}{2} \right|_0^2 = \frac{2^2}{2} - \frac{0^2}{2} = 2
\]