**MATH2214 - Abstract- Linear First ODE- Konaté**

## A. Linear First Order Differential Equations

### • A.1 Case of constant coefficients

Solve:

$$\frac{\mathrm{d}y}{\mathrm{d}t} = ay - b$$

where $a, b \in \mathbf{R}$.

The general solution is:

$$y(t) = ke^{at} + \frac{b}{a},$$

$k$ is a constant. If $y(0) = y_0$ then:

$$y(t) = \left(y_0 - \frac{b}{a}\right) e^{at} + \frac{b}{a}.$$

### • A.2 Case of variable coefficients

Solve:

$$\frac{\mathrm{d}y}{\mathrm{d}t} + p(t)y = g(t).$$

Use integrating factor or Leibniz method to find the general solution:

$$\begin{cases} y(t) = \dfrac{c + \displaystyle\int_{t_0}^{t} \mu(s)g(s)ds}{\mu(t)} \\ \mu(t) = \mathrm{e}^{\int_{t_0}^{t} p(s)ds} \end{cases}$$

where $c$ is a constant.

## B. Non Linear First Order Differential Equations

### • Case of separated variables

Solve:

$$M(t) + N(y)\frac{\mathrm{d}y}{\mathrm{d}t} = 0$$

The general (implicit) solution is:

$$H(y) + G(t) = c, \quad H(y) = \int N(u)\mathrm{d}u, \quad G(t) = \int M(u)\mathrm{d}u$$

$c$ is a constant.

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