DIFFERNTIAL EQUATIONS

First Order Linear Differential Equation

A first order linear differntial equation has the following form:

$$\frac{dy}{dx} + P(x)y = Q(x)$$

Integrating Factor

$$\frac{dy}{dx} + P(x)y = Q(x)$$

multiyplying the expression by the integrating factor $\mu(x)$

$$\mu(x)\frac{dy}{dx} + \mu(x)P(x)y = \mu(x)Q(x)$$

Setting: $\mu'(x) := \mu(x)P(x)$ and finding the integrating factor:

$$\mu'(x) = \mu(x)P(x)$$

$$\Leftrightarrow \frac{\mu'(x)}{\mu(x)} = P(x)$$

$$\Leftrightarrow \int \frac{\mu'(x)}{\mu(x)}dx = \int P(x)dx$$

$$\Leftrightarrow \ln(|\mu(x)|) = \int P(x)dx$$

$$\Rightarrow \mu(x) = e^{\int P(x)dx}$$