

First order differential equations

The following equations can all be solved by direct integration

1. $\frac{dx}{dt} = 4 \frac{t}{x^2}$ given that $x = 4$ when $t = 1$ $x = \sqrt[3]{6t^2 + 58}$
2. $\frac{dy}{dx} = -4x(y+4)$ given that $y = -3$ when $x = 2$ $y = \frac{e^8}{2} e^{-2x^2} - 4$

The following equations cannot be rearranged and integrated directly, but they are all equations with constant coefficients.

3. $3 \frac{dy}{dx} + 6y = 2e^{2x}$ given that $\frac{dy}{dx} = 0$ when $x = 0$ $y = \frac{1}{6}(e^{2x} - e - 2x) = \frac{1}{3} \sinh(2x)$
4. $\frac{dx}{dt} - 2x = 4e^{-2t}$ given that $x = 2$ when $t = 0$ $x = 3e^{2t} - e^{-2t}$
5. $\frac{dx}{dt} - 2x = 5 \sin(t)$ given that $x = -1$ when $t = 0$ $x = -\cos(t) - 2 \sin(t)$