Journal Template

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Abstract

Abstract goes here...

1 Declarations

$variable$; variable description; $variable\quad domain\quad and\quad range,\quad if\quad applicable$

2 Rule

$$\frac{dy}{dx} + p(x)y = f(x)y^n, n \neq 0 \vee 1$$

$$u = y^{1-n}$$

3 Pre-Derivation

Function must be of first order and in standard form...

$$\frac{dy}{dx} + p(x)y = f(x)y^n, n \neq 0 \vee 1$$

4 Derivation

Derivation goes here

5 Exempli Gratia

5.1 A basic problem...

Get in standard form and find n

$$\frac{dy}{dx} - \frac{3y}{2x} = \frac{2x}{y}$$
$$\implies n = -1$$

Use rule to determine the substitive variable and its derivative

We know $u = y^{1-n}$, so $u = y^2$

$$\implies y = u^{\frac{1}{2}}$$
$$\implies \frac{dy}{dx} = \frac{1}{2u^{\frac{1}{2}}}\frac{du}{dx}$$

Substitute

$$\frac{1}{2u^{\frac{1}{2}}}\frac{du}{dx} - \frac{3u^{\frac{1}{2}}}{2x} = \frac{2x}{u^{\frac{1}{2}}}$$

Get to standard form of a 1st order linear equation.

$$\frac{du}{dx} - \frac{3u}{x} = 4x$$

Solve differential equation with respect to u

We know, $\mu(x) = e^{\int p(x)dx}$

Let $p(x) = \dfrac{-3}{x}$

$$\implies \mu(x) = e^{\int \frac{-3}{x}dx} = e^{-3\,ln(x)} = x^{-3}$$

Multiple by $\mu(x)\dfrac{du}{dx}x^{-3} - 3ux^{-4} = 4x^{-2}$

Apply product rule

$$\frac{d}{dx}[x^{-3}u] = 4x^{-2}$$

Integrate

$$\int \frac{d}{dx}[x^{-3}u]dx = \int 4x^{-2}dx$$
$$x^{-3}u = \frac{-4}{x} + C$$
$$u = -4x^2 + C\,x^3$$

Substitute in for u

$$y^2 = -4x^2 + C\,x^3$$