Journal Template

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Abstract

Abstract goes here...

1 Declarations

variable; variable description; *variable domain and range, if applicable*

2 Rule

$$y_2 = y_1 \int \frac{e^{-\int P(x)dx}}{{y_1}^2}$$

3 Pre-Derivation

Anything that the derivation relies on goes here

4 Derivation

Assume y_1 is know. By preliminary theory...

$$\frac{y}{y_1} \notin k$$

$$\implies \frac{y_1}{y} = u(x) \implies y_2 = u(x)\, y_1(x)$$

5 Exempli Gratia

Find y_2 given:

$$x^2\, y'' - 3\, x\, y' + 4\, y = 0,\ y_1 = x^2$$

$$
\begin{aligned}
y =& u(x)\, x^2 = x^2\, u \\
y' =& 2\, x\, u + x^2\, u' \\
y'' =& 2\, u + 2\, x\, u' + 2\, x\, u' + x^2\, u'' \\
=& 2\, u + 4\, x\, u' + x^2\, u''
\end{aligned}
$$

$$
\begin{aligned}
0 =& x^2(2\, u + 2\, x\, u' + x^2\, u) - 3\, x(2\, x\, u + x^2\, u') + 4(x^2\, u) && \text{Substitution} \\
=& 2\, x^2\, u + 4\, x^3\, u' + x^4\, u'' - 6\, x^2\, u - 3\, x^3\, u' + 4\, x^2\, u && \text{Distribution} \\
=& x^4\, u'' + x^3\, u'
\end{aligned}
$$

$$
\begin{aligned}
&\text{Let } w = u',\ w' = u'' \\
\implies\ & 0 = x^4\, w' + x^3\, w \\
\implies\ & 0 = w' + \frac{1}{x}\, w && \text{Divide by } x^3
\end{aligned}
$$