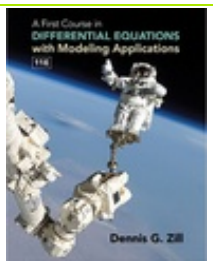
College

A First Course in Differential Equations with Modeling Applications, 11th Edition



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$$e^x y\frac{dy}{dx} = e^{-y} + e^{-2x-y}$$

Rewrite

$$\boxed{e^{a+b} = e^a e^b \Rightarrow e^{-2x-y} = e^{-2x}e^{-y}}$$,So

$$e^x y\frac{dy}{dx} = e^{-y} + e^{-2x}e^{-y}$$

Factor so

$$e^x y\frac{dy}{dx} = e^{-y}(1 + e^{-2x})$$

Separate the variables

$$y\frac{dy}{e^{-y}} = \frac{(1 + e^{-2x})}{e^x}dx$$

Apply $\frac{1}{e^{-n}} = e^n$ and distribute the right side

$$ye^y dy = \left(\frac{1}{e^x} + \frac{e^{-2x}}{e^x}\right)dx$$

Simplify

$$ye^y dy = (e^{-x} + e^{-3x})dx$$

Integrating by parts $\int ye^y dy$

$$u = y \Rightarrow du = dy$$

$$dv = e^y dy \Rightarrow v = e^y$$

So

$$\underbrace{\int ye^y dy}_{\int u dv} = \underbrace{ye^y}_{uv} - \underbrace{\int e^y dy}_{\int v du}$$

$$\int ye^y dy = ye^y - e^y + C$$

For $\int e^{-x} dx$ and $\int e^{-3x} dx$

Apply $\int e^{\pm ax} dx = \pm \frac{1}{a} e^{-ax} + C$

So

$$ye^y - e^y = -e^{-x} - \frac{1}{3} e^{-3x} + C$$

Factor

$$e^y (y - 1) = -e^{-x} - \frac{1}{3} e^{-3x} + C$$

RESULT

$$e^y (y - 1) = -e^{-x} - \frac{1}{3} e^{-3x} + C$$

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this was super

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1	$e^x y\frac{dy}{dx} = e^{-y}(1+e^{-2x})$	Rearranging
2	$ye^y dy = \frac{1+e^{-2x}}{e^x}dx$	Separate the variable
3	$\int ye^y dy = \int \frac{1+e^{-2x}}{e^x}dx$	Integrate both sides
4	$\int ye^y dy = ye^y - e^y + C$	Use integration by parts to find the integral of $\int ye^y dy$
5	$\int \frac{1+e^{-2x}}{e^x}dx = \int(e^{-x}+e^{-3x})dx$ $= -e^{-x} - \frac{1}{3}e^{-3x} + c$	Finding $\int \frac{1+e^{-2x}}{e^x}dx$
6	$e^y(y-1) = -e^{-x} - \frac{1}{3}e^{-3x} + C$	Therefore, the solution to the differential equation is as follows

RESULT

$$e^y(y-1) = -e^{-x} - \frac{1}{3}e^{-3x} + C$$

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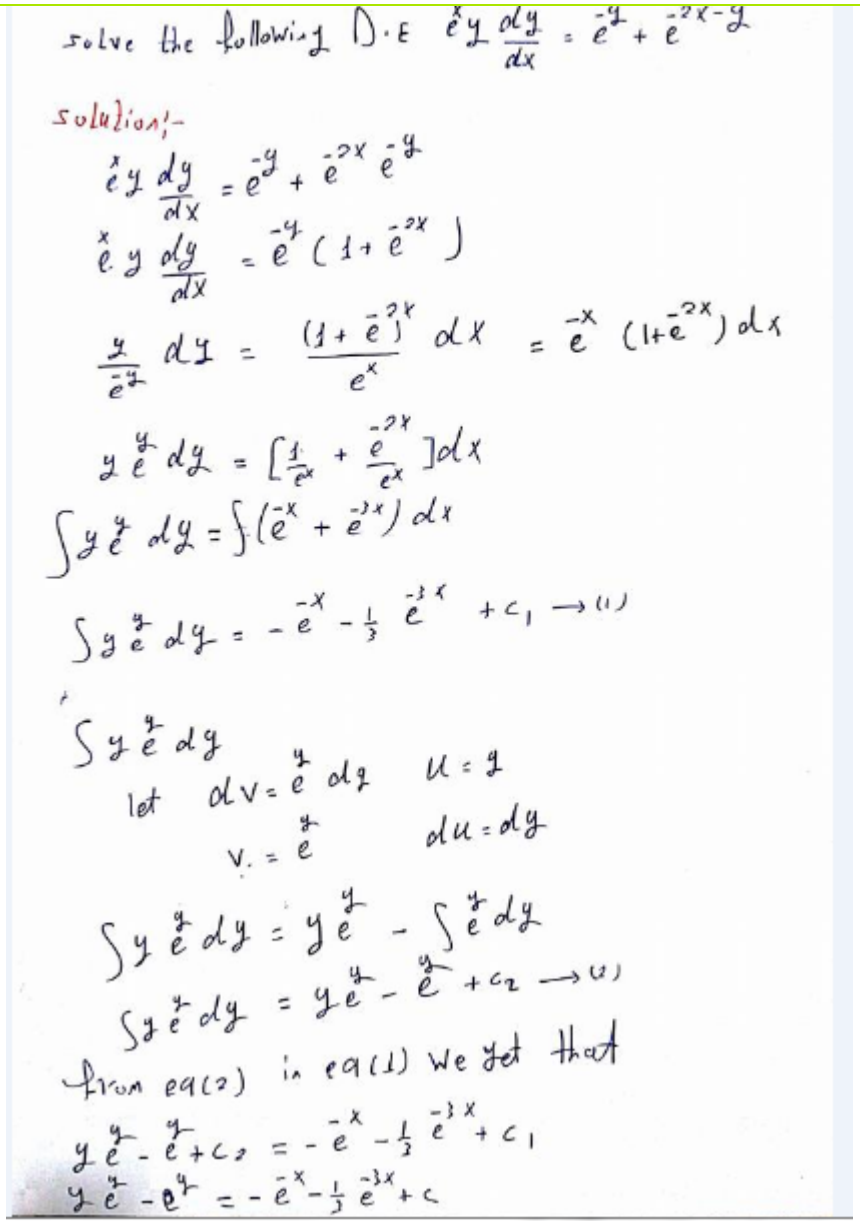

RESULT

see solution

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