

College

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



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Next >

52

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Heiner Borrero

5.0 ★ 1

1

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

Rewrite

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

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

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

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

Simplify

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

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

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

Factor

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

RESULT

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

seanpcrowley0408

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this was super

x²

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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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x²

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ahmed

3.7 ★ 0

1

solve the following D.E $e^x y \frac{dy}{dx} = e^{-y} + e^{-2x-y}$

solution:-

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

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

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

$$y e^y dy = \left[\frac{1}{e^x} + \frac{e^{-2x}}{e^x} \right] dx$$

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

$$\int y e^y dy = -e^{-x} - \frac{1}{3} e^{-3x} + c_1 \rightarrow (1)$$

$$\int y e^y dy$$

$$\text{let } dv = e^y dy \quad u = y$$

$$v = e^y \quad du = dy$$

$$\int y e^y dy = y e^y - \int e^y dy$$

$$\int y e^y dy = y e^y - e^y + c_2 \rightarrow (2)$$

from eq(2) in eq(1) we get that

$$y e^y - e^y + c_2 = -e^{-x} - \frac{1}{3} e^{-3x} + c_1$$

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

RESULT

see solution

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x²

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