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Free Response Question

Anthony Jones
8/27/20

a) Solve the ode via seperation of vas.

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

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

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

$$e^{2y} dy = e^{x} dx$$ ✓

Integrate both sides:

$$\int e^{2y} dy = e^{x} dx$$

$$\frac{1}{2} e^{2y} = e^{x} + c_0$$ ✓

Solve for y:

$$e^{2y} = 2e^{x} + c_0$$

$$2y = \ln(2e^{x} + c_0)$$

$$y = \frac{\ln(2e^{x} + c_0)}{2}$$ ✓

The solution to the ode is

$$y = \frac{\ln(2e^{x} + c_0)}{2}.$$ ✓

Nice Job!

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b) Verify your solution.

$$\frac{dy}{dx} = e^{x-2y}, \quad y = \frac{\ln(2e^x + C_0)}{2}$$

$$y = \frac{1}{2}\ln(2e^x + C_0)$$

$$\frac{dy}{dx} = \frac{1}{2}(2e^x + C_0)^{-1}(2e^x)$$

$$\frac{dy}{dx} = \frac{e^x}{2e^x + C_0}$$

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

Substitution for y:

$$\frac{dy}{dx} = e^{x-2\left(\frac{\ln(2e^x + C_0)}{2}\right)}$$

$$= e^x e^{-\ln(2e^x + C_0)}$$

$$\frac{dy}{dx} = \frac{e^x}{2e^x + C_0}$$

Not the correct way to verify

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The solution presented is a valid solution because the derivative expressed in terms of x equates to taking the derivative of our solution.