

February 12

Are the following two equations equivalent? Why or why not.

$$y = 4e^{5x}$$

$$y = e^{1.3869 + 5x}$$

$$\ln(4) = 1.3869...$$

$$e^{1.3869 + 5x} = e^{1.3869} e^{5x}$$

$$4e^{5x}$$

$$e^{\ln 4 + 5x} = e^{\ln 4} (e^{5x}) = 4e^{5x}$$

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Students will verbally explain how to find the solution to a differential equation

(using the words: separate, initial value, constant ...)

Find the particular solution to the differential equation

$$\frac{dy}{dx} = 6y \text{ if } y(0) = 3$$

$$\textcircled{1} \frac{dy}{dx} = 6y$$

$$\frac{dy}{y} = \frac{6y dx}{y}$$

$$\frac{dy}{y} = 6 dx$$

$$\textcircled{2} \int \frac{1}{y} dy = \int 6 dx$$

$$\ln|y| = 6x + C$$

$$\textcircled{3} \ln|y| = 6x + C$$

$$y(0) = 3$$

$$x=0, y=3$$

$$\ln 3 = 6(0) + C$$

$$\ln 3 = C$$

$$\textcircled{4} \ln|y| = 6x + \ln 3$$

$$\textcircled{5} e^{\ln|y|} = e^{6x + \ln 3}$$

$$|y| = e^{6x + \ln 3}$$

$$|y| = e^{6x} e^{\ln 3}$$

$$|y| = 3e^{6x}$$

$$y = 3e^{6x} \rightarrow \text{or } y = -3e^{6x}$$

$$y = 3e^{6x}$$

Differential Equation	Solution	Differential Equation	Solution
$\frac{dy}{dx} = 27y$ if $y(0) = 23$	$y = 23e^{27x}$	$\frac{dy}{dx} = 14y$ if $y(0) = 6$	$y = 6e^{14x}$
$\frac{dy}{dx} = 18y$ if $y(0) = 15$	$y = 15e^{18x}$	$\frac{dy}{dx} = 6y$ if $y(0) = 11$	$y = 11e^{6x}$
$\frac{dy}{dx} = 16y$ if $y(0) = 30$	$y = 30e^{16x}$	$\frac{dy}{dx} = 9y$ if $y(0) = 5$	$y = 5e^{9x}$
$\frac{dy}{dx} = 11y$ if $y(0) = 21$	$y = 21e^{11x}$	$\frac{dy}{dx} = 12y$ if $y(0) = 4$	$y = 4e^{12x}$
$\frac{dy}{dx} = 19y$ if $y(0) = 2$	$y = 2e^{19x}$	$\frac{dy}{dx} = 7y$ if $y(0) = 10$	$y = 10e^{7x}$
$\frac{dy}{dx} = 4y$ if $y(0) = 9$	$y = 9e^{4x}$	$\frac{dy}{dx} = 5y$ if $y(0) = 7$	$y = 7e^{5x}$

Exponential Growth

If

$$\frac{dy}{dx} = Ky \text{ and } y(0) = A \text{ (when } x=0, y=A)$$

Then

$$y = Ae^{Kx}$$

$$\text{If } \frac{dy}{dx} = 15y \text{ and } y(0) = -3 \text{ find } y$$

$$y = -3e^{15x}$$