
Consider the differential equation $(x-6)y''+(x+5)y'+x^3y=e^x$ with initial conditions $y(2)=4$ and $y'(2)=3$. Which of the following is something we do NOT need to check in order to guarantee the existence of a unique solution for the IVP on an interval I?

- A. That $x-6$, $x+5$, x^3, and e^x are continuous on I.
- B. That 2 is in I.
- C. That $x-6 \neq 0$ for any x in I.
- D. That $x-6=x+5$ for some x in I.

Answer(s) submitted:

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(incorrect)

Consider the differential equation $(x-5)y''+(x+7)y'+x^9y=e^x$ with initial conditions $y(5)=9$ and $y'(5)=5$. For what reason does our theorem FAIL to guaranteed the existence of a unique solution on the interval $I=(-\infty,\infty)$?

- A. Since $x-5=0$ for some x in I.
- B. Since 5 is not in I.
- C. Since one of $x-5$, $x+7$, x^9, and e^x are not continuous on I.

Answer(s) submitted:

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(incorrect)

Consider the differential equation $(x-14)y''+\frac{1}{x+9}y'+x^7y=e^x$ with initial conditions $y(-9)=8$ and $y'(-9)=8$. Why does our theorem fail to guarantee the existence of a unique solution on the interval $I=(-10,-8)$.

- A. Since $x-14=0$ for some x in I.
- B. Since -9 is not in I.
- C. Since $\frac{1}{x+9}$ is not continuous on I.

Answer(s) submitted:

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(incorrect)

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4. (1 point) Select the following which are homogeneous linear differential equations.

- A. $y'=2y$
- B. $x''-2x'+3x=0$
- C. $y''+3=0$
- D. $s^{(2)}+s=0$
- E. $y'=x$
- F. $y^3-y^2+y=0$
- G. $x^2\frac{dy^5}{dx^5}+e^x\frac{dy}{dx}=xy$
- H. $\frac{d^2y}{dx^2}-e^x\frac{dy}{dx}+\sin(x)=2$
- I. None of the above

Answer(s) submitted:

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(incorrect)

...equations:-

A linear ordinary differential equation of order n in the dependent variable y and the independent variable x is said to be homogeneous if it is of the form or can be expressed in the form

$$a_0(x)\frac{d^n y}{dx^n} + a_1(x)\frac{d^{n-1}y}{dx^{n-1}} + \cdots + a_{n-1}(x)\frac{dy}{dx} + a_n(x)y = 0 \quad \text{— (1)}$$

☑ A. $s^{(2)} + s = 0$ is a second order homogeneous linear equation. Here $n=2$, $a_0 = 1$, $a_1 = 0$ and $a_2 = 1$

☑ B $y' = 2y \Rightarrow \frac{dy}{dx} - 2y = 0$ is a homogeneous equation with $n=1$, $a_0(x) = 1$ and $a_1(x) = -2$

☒ C $y' = x \Rightarrow \frac{dy}{dx} - x = 0$ not an equation of the form (1) and hence not homogeneous.

☑ D $x^2\frac{d^5y}{dx^5} + e^x\frac{dy}{dx} = xy$ [$\frac{dy^5}{dx^5}$ should be corrected as $\frac{dy^5}{dx^5}$]

This is a homogeneous equation since it can be written as $x^2\frac{d^5y}{dx^5} + e^x\frac{dy}{dx} - xy = 0$

Here $n=5$, $a_0(x) = x^2$, $a_1(x) = 0$, $a_2(x) = 0$, $a_3(x) = 0$
$a_4(x) = e^x$ $a_5(x) = -x$.

☑ E $x'' - 2x' + 3x = 0$. Note that here x is the dependent variable.

$n=2$, $a_0 = 1$, $a_1 = -2$, $a_2 = 3$

☐ F. $y^3 - y^2 + y = 0$ If the exponents of y indicates derivatives, then it is homogeneous. otherwise not.

☒ G $y'' + 3 = 0$ Not homogeneous

☒ H. $\frac{d^2y}{dx^2} - e^x\frac{dy}{dx} + \sin(x) = 2$ not homogeneous since the