
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.

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.

Consider the differential equation $(x-14)y''+\dfrac{1}{x+9}y'+x^7y=e^x$ 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 $\dfrac{1}{x+9}$ is not continuous on I.

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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. $x^2\dfrac{d^5y}{dx^5}+e^x\dfrac{dy}{dx}=xy$
- H. $\frac{d^2y}{dx^2}-e^x\frac{dy}{dx}+\sin(x)=2$
- I. None of the above