Consider the differential equation $(x-6)y'' + (x+5)y' + x^3 y = e^x$ 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.

Solution:
SOLUTION:
The correct answer is D.
Correct Answers:

- D

Consider the differential equation $(x-5)y'' + (x+7)y' + x^9 y = e^x$ 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.

Solution:
SOLUTION:
The correct answer is A.
Correct Answers:

- A

Consider the differential equation $(x-14)y'' + \dfrac{1}{x+9}y' + x^7 y = e^x$ 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.

Solution:
SOLUTION:
The correct answer is C.
Correct Answers:

- C

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. $x^2 \dfrac{d^5 y}{dx^5} + e^x \dfrac{dy}{dx} = xy$

- H. $\frac{d^2y}{dx^2} - e^x \frac{dy}{dx} + \sin(x) = 2$

- I. None of the above

Solution:
SOLUTION:
The correct answer is ABDG.
Correct Answers:

- ABDG