Math 45, Fall 2020
October 14, Quiz 06

7

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Please show and explain your work where necessary. Good luck!!

1. (*6 points*) Is a unique solution guaranteed to exist for the following initial value problems on the given intervals. Explain you answers.
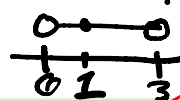
②
• $\ln(x)y''' + \frac{e^x}{x-4}y' - y = \cos(x)$

Linear nonhomogeneous $\neq 0$

a. (*2 pts*) $\underline{\ln(x)}y''' + \frac{e^x}{x-4}y' - y = \cos(x);$ $y(2) = 1,$ $I = (0,3).$

• $Y(2) = 1$
• $I = (0,3)$

$\rightarrow \ln(1) = 0, X = 1$

(i) coeff of highest order derivative $\neq 0$ on I
(ii) all coefficient function continuous on I
(iii) The "x_o" is in I

No it fails because $x=1$ and the Interval contains #'s between 0 & 3

b. (*2 pts*) $\underline{\ln(x)}y''' + \frac{e^x}{x-4}y' - y = x^2;$ $y(3) = 1,$ $I = (2,4).$

(i) coeff of highest order derivative $\neq 0$ on I
(ii) all coefficient function continuous on I
(iii) The "x_o" is in I

$\rightarrow \ln(1) = 0, X = 1$

$X_o = 3$ is 3 contained?

Yes all Pass

(i) Pass
(ii) Pass because 4 isn't included
(iii) Pass

c. (*2 pts*) $\underline{\ln(x)}y''' + \frac{e^x}{x-4}y' - y = x^2;$ $y(2) = 1,$ $I = (1,3).$

(i) coeff of highest order derivative $\neq 0$ on I

$X_o = 2$

$\rightarrow \ln(1) = 0, X = 1$

Yes all pass

(i) Pass 1 isn't included in I
(ii) Pass 4 isn't included in I
(iii) Pass $X_o = 2$ is contained in I

2. (*2 points*) In your own words, describe what it means for functions to be *linearly independent*.

3. (*2 points*) Provide an example of the following:

a. (*1 pt*)   A 3rd order linear homogeneous differential equation.

$$xy''' - \frac{2}{e^x} + y = 0$$

b. (*1 pt*)   A 2nd order linear nonhomogeneous differential equation.

$$y'' + \tan(x)y = e^x$$