Follow the directions carefully.
This quiz is closed book, closed
notes, but you may use your
homework solutions. Please
write in pencil. You must show
all your work to receive full
credit. If you get stuck, feel
free to ask me for help.

Thurs: LEAD
5-7, CSFG5D

26 Sept: Exam 1
Sec 1.1-
Consider the DE \((x-1)y''-xy'+y=0, \ x>1\).

a. Do \(f(x)=e^x\) and \(g(x)=x^2\) form a FSS on \(x>1\)?

State why or why not.
\[
f(x)=e^x \quad f''(x)=e^x \quad f'''(x)=e^x
\]
LHS: \((x-1)e^x-xe^x+e^x=0 \quad \int \Rightarrow f(x) \text{ is a solution}
\]
RHS: 0
\[
g(x)=x^2 \quad g'(x)=2x \quad g''(x)=2
\]
LHS: \((x-1)(2)-x(2x)+x^2=-x^2+2x-2 \quad \int \Rightarrow g(x) \text{ is not a solution}
\]
RHS: 0

Since \(g(x)\) is not a solution, \(f(x)\) and \(g(x)\) do not form a FSS.

b. Do \(f(x)=e^x\) and \(h(x)=x\) form a FSS on \(x>1\)?

State why or why not.
\[
f(x) \text{ is a solution}
\]
\[
h(x)=x \quad h'(x)=1 \quad h''(x)=0
\]
LHS: \((x-1)(0)-x(1)+x=0 \quad \int \Rightarrow h(x) \text{ is a solution}
\]
RHS: 0
\[
\omega(f,h)=\left|\frac{e^x \cdot x-e^x}{e^x}\right|=e^x-xe^x \neq 0 \Rightarrow f, h \text{ are LI on } x>1
\]

Since we have 2 LI solutions for a 2nd order DE, \(f(x)\) and \(h(x)\) form a FSS.

Bonus (2 pts): What's the difference between a general solution and a superposition? (Be specific).