Math 45, Fall 2020
October 28, Quiz 08

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

1. (*10 points*)

a. (*4 pts*) Find a general solution to the DE $y'' - 5y' + 6y = 0$.

Plug-in $y = e^{mx}$; $y' = me^{mx}$; $y'' = m^2e^{mx}$

This gives: $m^2e^{mx} - 5me^{mx} + 6e^{mx} = 0$

Factoring out e^{mx}

$\rightarrow e^{mx}(m^2 - 5m + 6) = 0$

So we need

$\rightarrow m^2 - 5m + 6 = 0$

$y_1 = e^{\left(\frac{-(-5)+\sqrt{(-5)^2-4(1)(6)}}{2(1)}\right)x}$ $\quad y_2 = e^{\left(\frac{-(-5)-\sqrt{(-5)^2-4(1)(6)}}{2(1)}\right)x}$

$= \frac{5+\sqrt{25-24}}{2}x$ $\quad = \frac{5-\sqrt{25-24}}{2}x$

$= 6/2 = 3x$ $\quad = 4/2 = 2x$

$y = c_1e^{3x} + c_2e^{2x}$

b. (*2 pts*) Note that $y_p = e^x$ is a solution to the DE $y'' - 5y' + 6y = 2e^x$ (you do not need to show or verify this). Provide a general solution to this DE.

$y = c_1e^{3x} + c_2e^{2x} + e^x$

c. (*4 pts*) We have that e^{2x} is a solution to the DE $y'' - 4y' + 4y = 0$. Use the method of reduction of order to find another (linearly independent) solution to this DE and write the general solution for this DE.

Need 2 soln

$y_1 = e^{2x}$ Too Long

Let $u(x)$ be an arbitrary function, and set $y = u(x)y_1(x) = u(x)e^{2x} = ue^{2x}$.

(a) Find y' and y''

* Remember ue^{2x} that "u" is a function of "x" so we have to use the product rule.

Recall The Product Rule

$(uv)' = u'v + uv'$

$y' = u'e^{2x} + u2e^{2x}$

$u'e^{2x} + u2e^{2x}$

$y'' = u''\sin(x) + u'\cos(x) + u'\cos(x) - u\sin(x)$

$= u''\sin(x) + 2u'\cos(x) - u\sin(x)$

Can use the formula too.

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