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

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

$Y_1 = e^{2x}$ 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
$\boxed{(uv)' = u'v + uv'}$

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

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

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

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

y''-4y'+4y=0

substitute y=e^kx

y'=ke^kx and y''=k2e^kx

substituting, we get
k^2-4k+4=0
(k-2)^2=0
k=2

The general solution is y=(C1+C2x)(e^2x)

This is complimentary solution.

there is no particular solution as R.H.S=0

General soution=complimentary solution.+particular solution

The general solution is y=(C1+C2x)(e^2x)