

Math 205

Quiz #9

1. Solve the following initial value problem:

$$y'' + 4y' + 8y = 0$$

$$y(0) = 0 \text{ and } y'(0) = -1.$$

$$y_1 = e^{\lambda x}$$

$$\Rightarrow \lambda^2 e^{\lambda x} + 4\lambda e^{\lambda x} + 8e^{\lambda x} = 0$$

$$\Rightarrow \lambda^2 + 4\lambda + 8 = 0$$

$$\Rightarrow \lambda = -2 \pm 2i$$

$$\begin{aligned} \Rightarrow y &= c_1 e^{-2x} e^{2ix} + c_2 e^{-2x} e^{-2ix} \\ &= c_1 e^{-2x} (\cos(2x) + i\sin(2x)) + c_2 e^{-2x} (\cos(2x) - i\sin(2x)) \end{aligned}$$

$$y(0) = c_1 = 0$$

$$y'(x) = -2c_2 e^{-2x} \sin(2x) + 2c_2 e^{-2x} (\cos(2x))$$

$$y'(0) = 2c_2 = -1$$

$$\Rightarrow c_2 = -\frac{1}{2}$$

$$\Rightarrow \boxed{y(x) = -\frac{1}{2} e^{-2x} \sin(2x)}$$