

MATH 54 SUMMER 2017, QUIZ 25

Find a solution to the following initial value problem.

$$y'' + 10y' + 25y = 0; \quad y(0) = 3; \quad y'(0) = -11$$

Auxiliary equation: $r^2 + 10r + 25 = 0$
 $(r + 5)^2 = 0$

roots: -5 with multiplicity 2

General Solution: $y(t) = c_1 e^{-5t} + c_2 t e^{-5t}$

IVP: $3 = y(0) = c_1 e^{-5 \cdot 0} + c_2 \cdot 0 \cdot e^{-5 \cdot 0} = c_1$

$$\begin{aligned} -11 = y'(0) &= -5c_1 e^{-5 \cdot 0} - 5c_2 \cdot 0 \cdot e^{-5 \cdot 0} + c_2 e^{-5 \cdot 0} \\ &= -5c_1 + c_2 \end{aligned}$$

$$\begin{aligned} \Rightarrow \quad c_1 &= 3 \\ c_2 &= -11 + 5c_1 = -11 + 15 = 4 \end{aligned}$$

Solution: $y(t) = 3e^{-5t} + 4te^{-5t}$